THE

ELECTRICAL REVIEW.

VOL. LXXV. JULY 31, 1914. No. 1,914.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: July 31, 1914. [No. 1,914.

	Page
London's Electricity Supply	161
Town Planning	162
Honour for Mr. Marconi	162
Copper	162
Tramway Rail Joints, by H. M. Sayers	163
Absolute Measurement of Electrical Resistance by Lorenz's Method (*illus.*)	164
Correspondence—	
Appointments in West Africa: A Warning	167
Mica and Micanite	167
Tubular Light Sources	167
Proposed Central Testing Institution	168
The Training of the Instrument Maker	168
Technical Errors in the Lay Press	168
Optical Signals for Aeroplanes and Ships (*illus.*)	169
Electrical Treatment of Milk (*illus.*)	169
New Electrical Devices, Fittings and Plant (*illus.*)	170
Legal	173
Parliamentary	176
Business Notes	176
Notes	183
City Notes	186
Stocks and Shares	188
Market Quotations	189
Electric Signalling and the Senghenydd Disaster	191
A Proposed Testing Institution for the Electrical Industry	193
Reviews	195
The Tramway Congress (*concluded*)	196
Rail Joints	196
Town Planning in Relation to Tramways	197
London's Electricity Supply	198
New Patents Applied For, 1914	200
Abstracts of Published Specifications	200

Contractors' Column ... Advertisement pages xxii and xxiv

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 983; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31a, Strand Arcade, Queen Street.
BERLIN: Asher & Co., Unter den Linden; Speyer & Peters, Unter den Linden 43, N.W. 7.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

LONDON'S ELECTRICITY SUPPLY.

THE long-expected recommendations of the Special Committee on London Electricity Supply have at last taken tangible shape in the report which was submitted to the L.C.C. on Tuesday last.

We publish elsewhere in this issue a lengthy abstract of the contents of the document; the Council, however, was not asked to approve it at present, but was recommended to make such arrangements as would enable the Special Committee to bring up definite proposals, after the recess, for the promotion of the necessary legislation in connection with the matter, and to authorise the giving of public notice of the Council's intention to consider these proposals on November 10th next.

The general principle involved in the Special Committee's proposals is the combination of municipal and private enterprise in such a manner as to secure efficient management, combined with municipal control—the scheme being, in fact, based upon the report of Messrs. Merz and McLellan, of which a long abstract appeared in our issues of April 24th and May 1st.

Thus it is proposed to set up a new electricity "authority," composed mainly of representatives of the L.C.C., but also of representatives of the adjacent County Councils and County Boroughs concerned.

The authority will be empowered to erect supply stations, to acquire existing municipal and private undertakings, and generally to amalgamate them into one undertaking. The authority is to provide all the capital required for purchasing existing concerns and two-thirds of that required for new works, while the remainder will be provided by a company, which will be entrusted with the management of the undertaking for 50 years, but the authority will be empowered to resume possession at the end of the period, on repayment of the capital provided by the company.

The area of supply includes the whole of the Greater London area, together with portions of the counties of Essex, Hertford, Kent, Middlesex and Surrey, and covers nearly 1,000 sq. miles; 60 per cent. of the energy sold in this area is produced within the County of London.

The capital requirements in the first instance, it is stated, will amount to about £7,000,000, and a subsequent expenditure of from £2,000,000 to £3,000,000 per annum during the next 20 years is expected.

While the Committee favours no particular company for carrying out the work, there is a suggestion that a combination of the existing companies would be welcomed, and the scheme provides for dividends up to 8 per cent. on this company's capital expenditure, and for the appropriation of 75 per cent. of any surplus profits for the reduction of the price of electricity to the consumer.

A valuable feature of the scheme is the proposal to set up a technical Committee on a permanent basis to supervise the technical operations of the company, the authority, however, retaining its control of all financial proposals.

This Committee, according to the *Times*, would consist of the chairman of the authority, the engineer of the authority, the financial adviser of the authority, and an outside member appointed by the Board of Trade.

It will be seen that the scheme is novel as far as this country is concerned, and that it represents a serious effort to bring together the various conflicting interests which have up to the present been unable to find sufficient ground for co-operation.

Private interests have in the past attempted to solve this problem and failed; at the present time the Borough Councils are engaged in the preliminaries of a bulk scheme on their own account, and there are rumours of both British and foreign banking groups coming forward with big schemes, if the present one fails.

It is obvious, therefore, that the present is no time for obstructive tactics, and that the L.C.C. will be well advised to seek some such solution of the knotty problem of electricity supply in its area, on the lines of mutual co-operation between municipal and private capital, as that outlined by the Special Committee.

We understand that the report was reached at the meeting of the Council on Tuesday, but its consideration was deferred until after the recess.

Town Planning.

THE paper read by Mr. Brodie, City Engineer of Liverpool, at the recent Tramway Congress, raises several interesting questions, and contains some novel and stimulating ideas relating to the transportation problem. One of the most prominent features of the paper was the confidence reposed by the author in the electric surface tramway as the most suitable and efficient means of speedy transport for passengers, a confidence which, as our readers are aware, we share with him. Relieved of the wholly unjustifiable burdens under which it groans, as we hope it soon will be, and permitted to utilise the speed of which it is fully capable, the tramway will have no difficulty in proving its superiority to the motor-omnibus. Mr. Brodie, therefore, takes it for granted that electric tramways must form an essential factor in any new scheme for the improvement of existing town areas and the development of adjoining districts, and he makes due provision for them in his plans.

The principal feature of novelty is the allocation of the centre of the broad highway to the tramways, with low hedges separating the tracks from the roadway, so that high speed can be attained without risk to other traffic. The prospect, from the tramway engineer's point of view, resembles a dream rather than reality—but it appears that in at least one instance in Liverpool, Mr. Brodie has successfully carried out his proposal.

The author rightly comments on the nuisance set up by the noise of tramcars, which can be greatly diminished by suitable means. We doubt whether the adoption of rubber tires can be regarded as feasible, even with the aid of double trolley wires – on the trolley omnibuses they are looked upon as a necessary evil; but much can be done to improve the gearing, as is proved by the experience of the motor-'buses, and the development of the ideal tramcar is still far from completion.

Honour for Mr. Marconi.

THE appointment of Mr. Marconi as an honorary Knight Grand Cross of the Victorian Order by the King, on Friday last, will be cordially approved by the electrical fraternity, upon whose members honours are so rarely conferred. However stormy may have been the career of the companies with which his name is associated, and whatever the ill-usage to which that name has been subjected at the hands of politicians, one fact is universally admitted—that Mr. Marconi himself has come through the ordeal with honour untarnished. That the present development of wireless telegraphy has been due mainly to his efforts, and that to him hundreds of human beings in peril at sea have owed their lives, are also matters of common knowledge. We therefore cordially offer our congratulations to Mr. Marconi on the royal recognition of his distinguished services to the nation and to the world, adding the hope that in due course, when the Imperial chain is completed and the Empire linked together by ethereal waves, a further distinction will be conferred upon him.

Copper.

THE position of the copper market has certainly not sustained any improvement during the past few weeks; indeed, the tendency of prices has been for the greater part weak, and considerable ground has been lost at times, though it must be admitted that the main depressing factors were centred outside of the actual position of the metal. Early this week, in view of the serious condition of Continental politics and of affairs in Ireland, the market was panicky. Under all the disappointing circumstances of the times, copper has really stood up very well, and it is not difficult to understand the moderate amount of optimism which has been expressed by leading spirits in the United States, when interrogated upon the intrinsic business position and prospects. The large absorption of refined copper by Europe this year has been the subject of general comment, and it is interesting therefore to note the expression of opinion of the head of the American Smelting and Refining Co., that the large export movement from America to Europe is due to the fact that the supply of metal other than American, which has been going into Europe for years past, has been gradually dwindling. The quantities coming to hand from Australia have been reduced owing to strikes and other economic conditions, and those from Japan have been lessened, because China and Japan are consuming more and more of the local output. It has been imperative, therefore, for Europe to look more and more to the United States, and the result has been seen in the increased importance of the shipments across the Atlantic of American refined copper. The bad political outlook, both in the United Kingdom and in Europe generally, has been the main depressing consideration, and until the position settles down, and the issue of war or peace becomes clear, it is useless hazarding conjectures as to what is likely to occur. War is always in the long run a bad feature, for it is a destroyer of commerce and of wealth, and cannot fail to work immense injury to trade everywhere in the present as in all past instances. War can only therefore accentuate the depression, whereas hopes of peace being maintained would be a "bull" factor. Turning from the main considerations calculated to sway markets at the present juncture, even though they are not directly connected with the position, it is seen that there has recently been a deterioration in the actual copper situation in so far as it is reflected in the United States statistics, which, for the month of June, showed an increase in the stocks of refined metal in first hands of close upon 10,000 tons, at 47,371 tons. The total is certainly very moderate, measured by the capacity of demand, being well below one month's supply, but it nevertheless indicates an increase of nearly 20,000 tons from the low-water mark of the year, at the end of March, and the "bears" seem to see in the increase which has taken place the beginning of an expansive movement, which will add a material tonnage to the total to be financed, and this at a time when Europe is trembling on the brink of general war. The symptoms are certainly disquieting, and, in the main, unfavourable to the maintenance even of present prices. Much, nearly everything, however, hangs upon the turn taken by international politics.

TRAMWAY RAIL JOINTS.

By HENRY M. SAYERS.

THE problem of jointing tramway rails in a satisfactory permanent manner has exercised the ingenuity of tramway men and inventors for a long time, and whilst there has been a heavy crop of devices and methods, the progress made has been slow, and opinions are much divided. This result follows from the fact that it takes a few years to prove a jointing method, and that it is very difficult to compare experiences made under varying conditions of traffic, soil, climate, and attention to maintenance.

The objects to be fulfilled are essentially to provide a continuously smooth wheel path, and a continuity of vertical strength or rigidity, across the joints. These requirements apply generally to rail joints on railways also, but there are some important differences in the conditions, due to the fact that tramway rails are surrounded by, and embedded in, the paving of the street, and are generally supported by a continuous substructure of concrete.

The first point of difference is the more important. Whilst on a railway the joints can be inspected and adjusted without entailing further expense, on a tramway inspection and adjustment of joints involves the removal and replacement of the surrounding paving, which is not only expensive in itself, but is detrimental to the paving as a whole, and causes inconvenience to the general street traffic. Further, any movement in the joint, either as between the two rails, or as between the joint as a whole and the substructure, loosens and damages the surrounding paving, especially in the presence of water.

Hence the bolted fish-plated joint, which gives sufficiently good service on railways, has never given complete satisfaction on tramways, because the loosening which seems to be inevitable cannot be remedied by the walking platelayer with his spanner every few days; and in practice joints are left until they become audibly or visibly slack before they are attended to. Slack joints mean battered or dished rails, so that with fish-plated joints a time comes when no tightening of bolts can provide a smooth wheel path, the rail table near the joint is depressed, and either new rails or some repair method is essential.

The desideratum is a joint which will deteriorate no more rapidly than the bulk of the rail, so that the life of the joint shall equal the life of the rail. Failing that, the next best thing is a joint which shall last as long as one laying of the paving—which may vary from seven to twenty years, according to the material and the traffic conditions—so that the relaying of paving will provide sufficient opportunity for joint re-adjustment and repairs.

The fish-plate joint itself has been improved by thickening and lengthening the plates, increasing the number of bolts from four to six, using spring washers and various types of locking nuts, as well as by modifying the "fishing angles" and by making the plates embrace the lower flanges of the rail; but these improvements have not more than kept pace with the increasing stresses due to the increased axle loads and speeds of the cars, and however well made and fitted, a plated joint makes its presence heard and felt after a few months of traffic at the most, and even before any perceptible slackening of the bolts occurs.

A little consideration of a rail joint as part of a beam carrying a rolling load on its upper flange will show that there must be some relative vertical movement of the rail ends as the load passes from one to the other, accompanied by a stretching of the fish-plate bolts under the loaded end. This is one cause of the first jar and sound heard from a new joint. It will also appear that the rail ends are not firmly butted by the jointing, and are not held in contact against the effect of temperature changes, or of the tensile and compressive stresses imposed on them by the wheel loads. This longitudinal freedom is another cause of the earlier movements in a new joint, and as both provoke jumping of the wheels, hammering and progressive loosening of the joint result.

It is theoretically possible, by machining and fitting the fish-plate and rail ends, and power riveting (instead of bolting) to make a joint as good and permanent as is made in a bridge girder, but the practical conditions of track building do not favour such a solution, which also seems to demand some modification of rail sections.

Mr. Brodie, of Liverpool, described a fish-plated joint to the Newcastle Congress of the T. & L.R. Association, in which the butt ends of the rails are drawn into close contact and longitudinal compression is maintained by the use of eccentric bolts, and stated that such joints had been tried with good results in Liverpool. If further experience confirms this, the plated joint may yet survive in some such form.

The provision of an anchor-plate is intended to maintain vertical rigidity, and to prevent longitudinal movement of the rails. If well riveted to the rail flanges, and the plated joint well fitted, it may (and sometimes does) make the joint more rigid than the rest of the rail, which will show itself by hammering and the formation of a depression near the running-on rail end. This is due to the change in vertical direction of a wheel running on to and leaving a more rigid portion of its track, and is exactly analogous to the depressions formed in trolley wires just beyond rigidly suspended ears.

On the other hand a deep anchor plate penetrates the concrete substructure, with the result that the rail has a weakened support under the joints, and will eventually fracture the concrete below. Inquiry shows that a good many tracks originally built with anchored joints are being reconstructed without them, and that in other cases anchors are being placed away from the joints, so that it seems that anchoring is being abandoned as accessory to joints at least. This, however, is another subject.

Until some form of track is evolved which can be unrolled in long lengths like a carpet, it seems that welding should give the ideal joint, mechanically and electrically continuous, provided that the welding process does not prejudicially affect the rail steel, and that uniformly good welds can be relied upon.

The Falk cast welding process, in its original form, did not claim to weld the rails, or even that the metal cast on amalgamated with the rail steel. It consisted in casting on to the rail base and web, a sort of chair of cast iron, which was not brought up to the rail head. It was customary to copper bond across these joints as they could not be relied on to preserve metallic contact. In more recent works, as developed by Mr. Winslow and applied at Coventry and Norwich, great care is taken to clean the rail surfaces before running the metal, and it is stated that permanent metallic contact is secured, in fact that the cast metal amalgamates with the rail steel. It seems that such a result can only have been attained by using a mixture approximating in composition and melting point to the steel, and by running it at a much higher temperature than that of cast iron. It would be very useful to have a published account of the method, and of the results obtained at Norwich. It is, however, a burning on, rather than a welding process, and apparently no attempt is made to bring about a weld of the head. The joint is therefore a place where the upper flange of the beam is cut through, and it seems that under a rolling load such a cut is certain to have some effect upon the path of the wheel, as well as being a point of weakness. The method involves the use of a cupola and blowing plant (which has been re-

duced to a comparatively moderate size and cost), in the street.

The electric welding process, as developed for tramway track by the Lorain company, gets very close to the continuous rail, since the rail ends properly fitted are pressed together whilst at welding heat. The butt weld is reinforced by fish-plates welded to the rail web at their centres and ends.

So far as can be ascertained this joint has given excellent results. The plant required is large and expensive, and requires a power supply approaching 200 KW. for its operation. The total cost per joint is therefore somewhat heavy, and has prevented such a wide adoption of the process as its intrinsic merits seem to justify.

The Thermit process, as first adapted to rail jointing, was essentially a development of the Falk cast welding, the melting of the metal being accomplished by the Goldschmidt alumino process of simultaneous reduction and melting of iron oxide. In respect of plant, this method has a considerable advantage over the Falk, a small crucible taking the place of a cupola and blower. In respect of result, the temperature of the fused metal is so high that it melts the web and base of the rail, and unites bodily with the steel. The composition of the metal is also under control, so that the cast-on band is in effect a steel casting. It has always been claimed that Thermit joints need no copper bonds.

In the more recent practice of this method, the rail heads are butt welded in addition to the cast welding of the web and flange, thus getting rid of the weakness of a cut-through head.

The rails are clamped in their proper alignment, the heads faced off parallel and brought into close contact by the clamp screws. The metal of the cast is sufficient in quantity to reach nearly to the rail head, and the slag (fused alumina) surrounds and covers the rail head to a considerable thickness, raising the steel in a short time to welding heat; then the clamps are screwed up, butting the heads together with a pressure which produces a very decided upsetting at the joint. This upsetting is filed off flush with the body of the rail, and the filing should reveal no line at the joints. It has been found that certain rail steels do not weld readily, and for such steels a soft steel "shim" is inserted between the faced rail-heads, which seems to have the effect of "letting down" the rail steel sufficiently to ensure a good weld.

This method of welding is very attractive in principle, and the handiness of the apparatus is a great recommendation. So far as can be ascertained, Thermit welds made on a large number of British tramways during the last six years have given excellent results in every way. It will be obvious, however, that any system involving the integral welding of fairly high carbon steel rails, needs careful and systematic operators, and that this must apply alike to the Falk, Lorain, and Thermit joints. Another observation applying to these systems is that they all involve a "heat treatment" of the rail steel which may considerably modify its structure and mechanical qualities, equivalent to insertion into the head of a softer or harder metal, bound to show up in subsequent wear. This is a matter upon which the results of independent tests, as well as the results of actual experience testified to by independent users, are much to be desired.

There are also in use joints in which the ordinary fish-plates are welded to the rail by what is in effect a "Benardos" arc welding process. In the Tudor "Quasi Arc" process special iron electrodes are used, which furnish part of the weld material. In addition a strip of new metal is welded to the rail table across the joint. This method has been used in a good deal of repair work, rectifying "dished" rails by filling up the dishes with new metal, and grinding it off flush. This process is very highly spoken of by some tramway managers who have tried it for repair work. If it has been used for new construction, the writer has failed to see the notices.

Mr. Humphries, at the Newcastle Congress of the T. & R. L. Association, described another welded fish-plate method which he has developed and used on the Birmingham and Midland Tramway Committee's lines. It is an arc welding process, using a carbon negative electrode, the rail being the positive pole of the arc. The fish-plates are welded solid to the rails, after being tightened up.

Both the Tudor and the Humphries joints are therefore fish-plated joints of the usual form, with the fish-plates welded to the rails. This gets rid of the weakness of the fish-plated joint in permitting longitudinal movement of the rail under temperature and load stresses, and interposes a much greater resistance to relative vertical movements of the rail ends than the bolted fish-plate. These methods are exceedingly promising, and they do not leave the integrity of the whole joint dependent upon a weld, a fact which will recommend them to many people.

Some precautions must be taken to avoid burning the rail steel, and to ensure that the new metal run into the welds is of suitable character, especially when such new metal is run on the rail table across the joint.

In arc welding not more than 100 volts are needed across the arc and the steadying resistances. It is therefore highly advantageous to the supply and distributing plant to interpose a motor-generator between the trolley wire and the arc, as is done by Mr. Humphries, so reducing the current taken from the trolley wire by 80 per cent., as well as giving the operator the choice of polarity, which is of considerable importance in carbon arc welding.

The repair and reconstruction of tramway tracks which have been in use for from 10 to 15 years is now in progress in many towns, and engineers in charge should be able to exchange sufficient information bearing on the comparative merits and total cost—primary and maintenance—of the various jointing methods used on the older tracks, and those of more recent introduction, to permit of the formation of definite and authoritative opinions as to the most economical forms to adopt; and, it is to be hoped, to lead to a large saving in the future maintenance of permanent way and its paving.

ABSOLUTE MEASUREMENT OF ELECTRICAL RESISTANCE BY LORENZ'S METHOD.

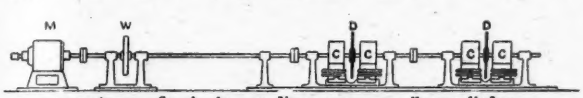
(*Abstract of a paper by* F. E. SMITH, *of the* NATIONAL PHYSICAL LABORATORY. *From the Philosophical Transactions of the* ROYAL SOCIETY, 1914.)

IN the method devised by Lorenz in 1873 for the absolute measurement of electrical resistance a metal disc was rotated uniformly in a magnetic field produced by a circuit in a coaxial coil. Wire brushes made contact with the disc at the edge and centre, the circuit was completed through a galvanometer and a resistance R, and the induced voltage MCN was balanced against the P.D. RC, where M was the coefficient of mutual inductance of the coil and the circle formed by the disc edge, N the revolutions per second, and C the current traversing resistance and coil. Thus when balanced R=NM; and M being calculated from the dimensions of the coil and disc, R was determined.

Lord Rayleigh (*Phil. Mag.*, Nov. 1882) discussed Lorenz's method in considerable detail and came to the conclusion that, in spite of certain difficulties, it was the best that had been devised. The first of these was the necessary smallness of the resistance which could be measured directly, and he showed how it could be met by the use of shunted

resistances, which have been utilised in part of the present work. He also pointed out the troublesome disturbances arising from thermo-electric effects at the sliding contacts, and from terrestrial magnetism. Both of these can, however, be eliminated. as is here fully shown, by taking a sufficient number of readings, with reversals of the current, provided precautions are taken to prevent sudden fluctuations in the magnitude of these effects.

The only serious difficulty remaining is the unavoidable error in determining the mean radius of the coil, which is involved in the calculation of the coefficient of mutual inductance; and Lord Rayleigh showed that, by using two coils separated to a considerable distance, it was possible so to proportion the radii and the distance apart of the coils as to reduce this error to negligible dimensions. Similar considerations apply to the discs. The apparatus was accordingly constructed with two discs, about 53 cm. in diameter, each with its pair of exciting coils, mounted on a 5-cm. copper-aluminium shaft whose magnetic permeability was indistinguishable from unity. Two shafts, one of phosphor bronze, of permeability 1.006, the other of less pure copper aluminium, of permeability 1.002, had previously been made and rejected. The whole arrangement with the driving motor is shown in Fig. 1.



M, motor; W, fly-wheel; D, D, discs; C, C, C, C, coils on cylinders.

FIG. 1.—GENERAL ARRANGEMENT OF APPARATUS.

The distance between the centres of the motor and of the nearest coil was amost exactly 4 m., at which distance the effect of the stray field on the mutual inductance was experimentally imperceptible, and a calculation by Searle of the effect of an equivalent iron sphere showed it to be no more than 1 in 10,000,000.

It was found impossible to avoid thermo-electric troubles with brushes making contact at the shaft and disc-edge, and the apparatus was therefore modified by making the discs mere carriers for ten insulated wires having their ends attached to ten segments fixed on the periphery of each disc, and passing through a central hollow in the shaft and along radial slots in the discs. The whole arrangement for a resistance measurement is shewn diagrammatically in Fig. 2, in which the current in the

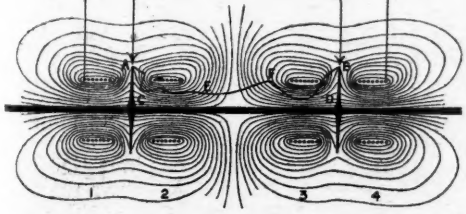


FIG. 2.—MAGNETIC FIELD AND DIAGRAM OF CONNECTIONS.

coils 1 and 2 is in the opposite direction to that in the coils 3 and 4, so that the resulting magnetic fields are opposed in direction, and the value of the fields at points in the neighbourhood of the edge of a disc is zero, or nearly so. Brushes of phosphor bronze wire, of the same alloy as that of the segments, make contact with the latter, and the P.D. between the brush contacts at the ends of a single wire, or that between five wires, is balanced against the P.D. between two points on a standard resistance, the current through which is the same as that flowing through the four coils. It should be noted that the P.D. produced between the ends of the rotating conductors, since these pass through the magnetising coils, depends, not on the shape of the conductors, but only on the positions of their ends. For example, the P.D. between A and B would be the same for either of the conductors A C D B or A E F B. The segments are insulated from the disc and from each other.

The high peripheral speed (about a mile a minute) of the discs as compared with that of the original Lorenz apparatus, largely increases the brush difficulties arising from thermo-electric effects and inconstancy in the resistance of the galvanometer cir- The brush of one to eight turns (generally three) of cuit, the latter being by far the more troublesome. fine stretched wire is shewn in Fig. 3, the wire being wound in screw cut grooves on small brass cylin-

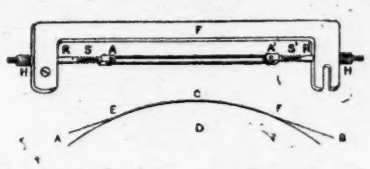


FIG. 3.—ONE OF THE BRUSHES.

ders which could turn about, or be clamped to, the axles A A¹. The ends of the wire were soldered to the cylinders, and the brush was put in tension by turning the milled heads H H. The spiral springs S S¹ were made of stout phosphor-bronze wire and were soldered to brass rods R R¹, of square section, sliding in square cut grooves in the frame F. Such a brush offers little resistance to a stream of air, and with the aid of copious petrol lubrication, its vibration could be reduced to a practically negligible amount by suitably adjusting the tension. Moreover, as shown diagrammatically in the lower part of Fig. 3, a stretched wire A B is capable of a long contact arc E F with the disc D, and the maximum pressure, and therefore the maximum rise of temperature, with corresponding maximum thermo-electric effect, will occur close to the mid-point C, falling to zero at E and F. The brushes could be placed either all ten in series, giving an unbroken P.D. due to five rotating conductors; or in two sets of five in parallel, giving the same P.D. as from a single rotating conductor. Under the latter conditions the rapid variations in thermo-electric voltage could often be kept within 0.1 microvolt, less than a fiftieth of the variation in the case of any other form of brush experimented with.

In order to maintain the balance of the bridge over a considerable time for a series of readings, the following method of speed regulation was adopted:—A condenser placed in one arm of the bridge was charged and discharged four times per revolution by means of a commutator on the motor shaft, the other arms consisting of platinum-silver resistance coils. To ensure constancy in the arms of the bridge, the condenser and coils were kept in a constant temperature room, a small variable resistance in series with one of the arms being adjusted to secure a balance when the speed was that best suited to the measurement to be made. The speed of revolution was then maintained constant by an assistant applying a variable pressure to the flywheel in such manner as to keep the spot of light from the galvanometer in a constant position. This was essential in view of the fact that balance resulted only from a particular frequency of charge and discharge, and it was found possible, for twenty minutes' runs, to keep the maximum deflection of the spot within 2 mm. The speed was calculated from the record of a chronograph-drum capable of operating for 80 minutes, controlled through a mercury contact on the pendulum of the standard clock and a relay operated continuously by the current.

The cylinders on which the coils are supported are of "First Statuary" Carrara marble. Sixteen

cylinders were prepared in the rough, and twelve rejected for small flaws and veins discovered after turning up from specially selected blocks. The four selected cylinders were then accurately turned, and double helical grooves cut in them to receive the coils, a process occupying about four weeks. The coils were wound under a uniform tension equivalent to a weight of about 4 kilogrammes. The mean diameters, and the pitch, respectively, of the coils were determined by a series of elaborate measurements made by specially designed measuring machines, constructed by Sir W. G. Armstrong, Whitworth and Co., who also built the heavier portions of the apparatus itself, the lighter parts being made in the National Physical Laboratory, where it is permanently installed as a memorial to the late Professor J. Viriamu Jones. The Drapers' Company of London, which had promised him the funds for the construction of such an instrument, placed £700 at the disposal of the National Physical Laboratory for the memorial, and Sir W. G. Armstrong, Whitworth and Co. were kind enough to render material assistance by executing their portion of the work at considerably less than its actual cost.

Before assembling the parts of the machine, a concrete block, built up of Keene's cement and Thames ballast, was prepared as a foundation. This block is non-magnetic, is 8 metres long, 80 cm. wide, and 120 cm. deep. Slide rails of gun-metal were bolted in position on this block, and to secure greater stability the rails were sunk 5 cm. into the concrete. The rails are in three pairs: one pair supports the motor; a second pair the fly-wheel; and the third pair, nearly 4 metres in length, supports the portions with the rotating discs. A period of twelve months was allowed for the concrete block to assume approximately constant dimensions, and at the end of that time the upper surfaces of the rails were scraped to obtain flat surfaces and to ensure these surfaces lying in the same horizontal plane.

After the alignment and running adjustment had been completed no portion of the machine gave

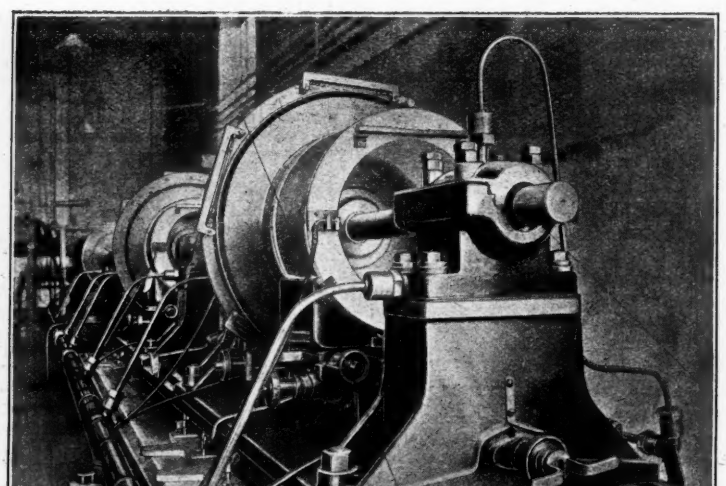
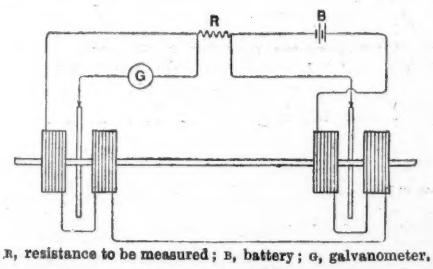


Fig. 5.—End View of Lorenz Apparatus.

the slightest trouble. The parts are so well balanced that the tremor of the concrete base is scarcely perceptible. The pair of reading microscopes used to determine the distance apart of two coils, are in consequence found to give readings which are reliable to within a thousandth of a millimetre, even at 1,040 revolutions per minute.

The coefficient of mutual inductance of the coils was obtained in terms of elliptic integrals by means of J. Viriamu Jones's formula (Roy. Soc. Proc., vol. 63, p. 198, 1898), the values of the integrals being calculated by interpolation from Legendre's tables; and in order to check possible inaccuracies in the tables, a number of the integrals were calculated by quadric transformation. The formula used for the corresponding coefficient for coils and contact circles was one due to Rosa and Grover, which, for a long coil, is very exact and easy to use to the precision required. Corrections for conicality in the coils and for variations in pitch, which are fully discussed in the paper, were applied. They were very small in amount.

The coils were adjusted to parallelism to the shaft by the aid of micrometer readings which were found to agree within 0.01 mm., and coaxiality was obtained, originally by a mechanical method subject to an error not exceeding 0.02 mm., afterwards discarded for an electrical method fully described in the paper, which reduced the error to 0.01 mm., and an error 0.1 mm. would introduce an error into the



R, resistance to be measured; B, battery; G, galvanometer.

Fig. 4.—Diagram of Connections.

resistance measurements of about one part only in 100,000,000, which would of course be quite negligible. The coils on all of the cylinders were adjusted to the same mean distance from the contact circles by successive balancing, with reversals of the current to eliminate effects due to difference of flux through the discs, arising from the current. The error was within 0.1 mm., which gave the accuracy required.

The arrangement of the apparatus for a measurement is shown in Fig. 4, the resistances measured being of the nominal values 0.001 ohm, 0.002 ohm, and 0.01 ohm. Fig. 5 shows the apparatus as seen from one end, and fig. 6 is a side view, showing the whole of the apparatus with the exception of the motor.

The possible magnetic field due to the current in the leads was found to be negligible, as also were possible electrostatic effects. The possibility of error in the calculation of mutual inductance owing to the finite section of the wire has been investigated by Searle, who has shown the correction to be negligible. The author points out, in conclusion, that:—

"The determination of a resistance in absolute measure is subject to a number of small errors, the greatest of which is associated with the determination of the mean radius of the coils. This error is probably not greater than one part in 100,000, and if the remaining errors were all of one sign it is unlikely that their sum would exceed another one part in 100,000. We believe, therefore, that the absolute measurements of resistance which we have made are correct within 2 parts in 100,000."

The mean of the results tabulated leads to the conclusion that:—

A resistance of one international ohm is equal to 1.00052 ± 0.00004 ohm (10^9 cm./sec.), the possible error ± 0.00004 being approximately the sum of those involved in the realisation of the ohm and the international ohm. From this it follows that:—

The ohm 10^9 cm./sec. is represented by the resistance at 0°C. of a column of mercury 14.446 ± 0.0006 gm. in mass, of a constant cross-sectional area (the same as for the international ohm) and having a length of 106.245 ± 0.004 cm. Some of the principal previous determinations are:—

1882, Rayleigh	...	106.26 cm.
1882, Glazebrook	...	106.25 ,,
1883, Rayleigh	...	106.24 ,,
1885, Wiedemann	...	106.265 ,,
1889, Dorn	...	106.243 ,,
1892 Himstedt	...	106.259 ,,

We may therefore accept Mr. F. E. Smith's claim that the instrument here described "may be used for absolute measurements of resistance with a precision satisfying all present demands whether purely scientific or technical." Moreover, as he points out, "it can be used at any time; the dimensions of all its parts can be checked when desired, the probable error associated with a single measurement is small, and the observations do not unduly tax the experimenters."

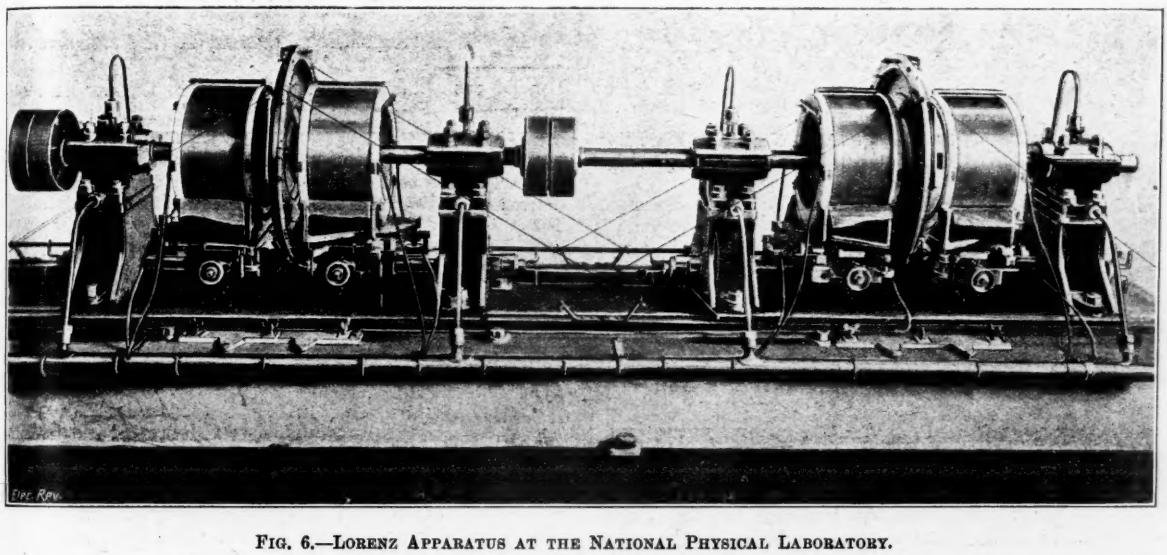


Fig. 6.—Lorenz Apparatus at the National Physical Laboratory.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Appointments in West Africa: A Warning.

I have read with interest letters inserted at different times, warning those who apply for positions in the Far East and India, but I should like to put on their guard electricians who think of applying for positions in West Africa. No one who has had an electrical training in the workshop, or lighting station, should go out there (under the various designations of electricians, mechanicians, &c.) under a salary of £300-£350 per annum, with *first-class passage* out and home. The latter should be insisted upon, otherwise they will be made to travel second-class in the Colonies, which only those who have been out there can understand. It is enough to say that any self-respecting European would be turned sick at the sight.

I must also point out by way of comparison (as his salary is none too high for existence) that a platelayer who gets his 18s. to 25s. a week in England, out there receives £220-£250 per annum, plus a travelling allowance of 3s. per day.

Electricians, who are usually stationed only at large towns, where the cost of living is very high, do not draw any allowances, on account of not travelling, so have only their bare salary to live on and to provide an outfit which at least runs into £25, and are compelled to subscribe to various Government funds, which rob them of about £20 per annum. They are usually in debt for the first six or seven months in the colony, and longer if they make friends and wish to join in the social life of the place. I dare not venture to touch on the health point, which, I think, is only too well known, or point out how it unfits one in many cases for work at home.

A Victim.

Mica and Micanite.

I have read with much interest the remarks of Messrs. Wiggins & Sons, in their letter published in the "Correspondence" columns in your issue dated July 17th, 1914, and it is with pleasure that I take the opportunity of expressing agreement with them in their complaint about the loose way in which mica and micanite are specified and supplied. The trouble and annoyance caused by the apparent lack of accurate distinction between mica and micanite cannot be overrated, and, as a designer of apparatus in which very large quantities of both pure mica and heat-resisting micanite are used, I should be very glad to see the matter taken up by the Electrical Standards Committee or the Institution of Electrical Engineers, as, owing to the importance of mica and micanite in the electrical industry, it is surely a matter which comes within the scope of these bodies.

Instances are within my knowledge where micanite has been supplied by manufacturers when mica has been ordered. True, the micanite appeared to have been made up of virgin amber mica, yet the cement used in its construction made it quite unsatisfactory for the purpose for which it was required. The provision of the wrong article in these cases was not, I feel sure, in any way due to a wish on the part of the suppliers to provide a cheaper article, but merely to a misunderstanding of the customer's exact requirements owing to the present indiscriminate use of the terms "mica" and "micanite."

H. W. H. Warren.

Bristol, *July 25th*, 1914.

Tubular Light Sources.

In your issue of July 17th there is a paragraph, quoted from the *Electrical World*, which refers to the intensity of illumination due to tubular sources of light.

The statement is made that the intensity from such a source varies inversely as the distance. That this is incorrect is shown by the accompanying diagram (fig. 1). P Q is the tubular source. A B C D is the illuminated area.

At twice the distance from the tubular source, the light passing through A B C D will cover the large area A_1 B_1 C_1 D_1,

FIG. 1.

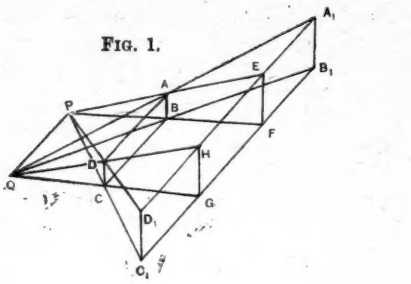


FIG. 2.

which is more than twice as large as A B C D. The intensity of illumination over A_1 B_1 C_1 D_1 will be less than half that over A B C D.

The law connecting intensity of illumination with distance from source for a line source is extremely complex. It approximates more nearly to the inverse square law than to variation inversely as the distance. This is shown by the following example.

Consider a point source of light of 9 C.P. At 1 ft. the intensity is 9 ft.-candles, at 2 ft. the intensity is 2·25 ft.-candles. Now imagine this point source replaced by nine 1-C.P. lamps placed 1½ in. apart, so as to cover a total distance of 1 ft. (fig. 2). With this arrangement the intensity over a small area placed 1 ft. away is 8·01 ft.-candles, if the area is placed 2 ft. away the intensity is 2·17 ft.-candles. The intensity is in each case less with the line source than with the point source, and the law with the line source approximates to the inverse square. It is clear that the greater the distance the closer the approximation.

H. B. Howard.

Clare College, Cambridge.
July 20th, 1914.

[If a *short* tube is considered, obviously the conditions will approximate to those obtaining in the case of a point source; but if the tube is long, as in the case of the Moore light or the Neon lamp, the statement quoted from our contemporary is practically correct. Our correspondent in fig. 1 fails to take into account the light which, emanating from P Q, reaches A_1 B_1 C_1 D_1 without passing through the area A B C D; this is the greater as the length of the tube is greater.

The subject is admittedly complex, and rather than attempt to demonstrate the truth of the note in question, we have recourse to the unimpeachable authority of Mr. A. P. Trotter:—"It may be shown mathematically that when a source of light is an indefinitely long line, the illumination produced by it on a surface facing it is inversely as the distance of the surface from the line." ("Illumination," p. 121).—EDS. ELEC. REV.]

Proposed Central Testing Institution.

The letter *re* above in your Correspondence columns is full of matter, important not only to the electrical industry, the public and commerce generally; but it has also a national and international bearing of some importance on exports and imports, as well as other points.

As the Industrial Committee of the I.E.E. is dissolved, I think the insertion of Mr. Wordingham's letter at this period is most fitting, and it is up to those whose interests are involved that the matter should be vigorously tackled in some such way as suggested.

From the aspect of national enterprise, such an institution is much to be desired. I am not surprised that the electrical industry did not support the idea when put forward, by Mr. Wordingham in his paper to the I.E.E. in 1899. "John Bull" ever was slow to take up anything in the nature of an innovation; it is only when a matter begins to have any adverse effects that "John Bull" becomes active. It is obvious that something ought to be done in the matter, and I heartily agree with Mr. Wordingham that such an institution should be British and set its own standards.

The value of such an institution would grow more and more, and if those who have not given the subject thought will now do so, I am sure they will be struck with the amount of material pointing to the need of it.

I trust that the matter will be treated with that zeal and continuity of effort it deserves, and that we shall have in our midst the finest institution of the kind at no distant date.

G. St. John Day.

Oldham, *July 27th*, 1914.

The Training of the Instrument Maker.

The matters raised in Mr. R. W. Paul's letter in your current issue are of much importance to electrical engineering. It is often forgotten that engineering is based on measurement.

I do not think that manufactories in the London district suffer to the same extent as do works in the provinces from the dearth of well-trained instrument makers and of apprentices. This is largely due to a natural preference on the part of the best trained men to remain in and about the centres of the trade.

A somewhat lengthy acquaintance with successive influxes of apprentices into electrical engineering (not confined to one or two factories only) has made it clear to me that there is an unwillingness to adopt the lighter sides of the business, such as instrument making. The glamour of large machines and power plant is too much for them.

Thus it is that some manufacturers in the provinces have found it well specially to organise their methods of manufacture, and to some extent to rearrange their designs—doing more and more of the work as machine work, and replacing, for instance, certain hitherto orthodox types of construction and finish.

This has enabled them to employ, for much commercial instrument-making at any rate, the labour procurable in the district. Obviously for much work, and especially development work, the skilled, well-trained man is essential, and any plan for attracting more apprentices and inducing them to become interested and efficient is welcome.

Mr. Paul's interest in this matter is a favourable sign. Speaking from a fairly long experience, there are many points in the design of new and special instrument work which cannot always be satisfactorily dealt with in the drawing office, and are developed on the bench. Here comes in the skilled interested man, and there "isn't enough of him."

Good and tactful foremanship is more essential in instrument making than in any other branch of electrical engineering, especially if apprentices are to be well trained and encouraged—bullying methods on the foreman's part are disastrous and should be checked early.

C. H. Wright.

Chelmsford, *July 27th*, 1914.

Technical Errors in the Lay Press.

I read your leader in the issue of May 29th with great interest, and as showing the justification of what you say, I enclose a cutting from the *Daily Telegraph* of July 4th last, confirming every word of your article.

It seems astounding that such a well-known and otherwise careful paper should print such a lot of "rubbish" without apparently taking the slightest trouble to verify technical details, which could have been done so easily.

The "Hugo" referred to is the "Hughes," which in French is pronounced with a hard "g." Submarine cables, including the Atlantic cables, have been duplexed for very many years.

What the writer really intended to refer to was the establishment of Duplex-Baudot working on the Algiers circuits. The Baudot was duplexed in England in 1910,

but it is only this year that the French Administration has adopted Duplex-Baudot.

A. C. Booth.

G.P.O., London, E.C.

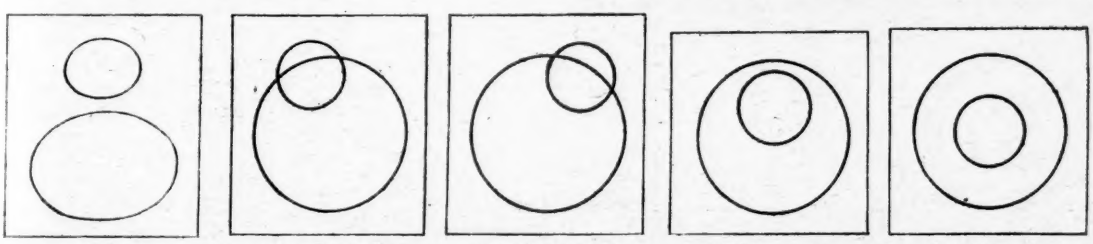
[The cutting deals with a "Striking French Discovery," "Duplex Working on Submarine Cables" (headlines), and enthusiastically describes the application of duplex working to the Marseilles-Algiers cable on the Baudot system. The writer says "at last it was announced that the secret had been found for transmitting over the same cable and simultaneously a separate dispatch from each end."—EDS. ELEC. REV.]

OPTICAL SIGNALS FOR AEROPLANES AND SHIPS.

[BY OUR BERLIN CORRESPONDENT.]

SEARCHLIGHTS have been used successfully by aeronauts and airmen for finding their way by night or in dense fogs. A Berlin architect, Edgar Hönig, has recently patented a new type of optical signal likely to prove even more useful in this connection, and which, moreover, lends itself to other applications.

This signal comprises a system of two or more circles (or similar figures) arranged behind, inside or below one another, vertically or horizontally, so that their centres will coincide. Their peripheries are, by night (or in case of fog), outlined with electric lamps.



Too high. High and to the left. High and to the right. Close to ground. On the ground.

This simple system affords a reliable means of indicating to aircraft, or vessels, their position with regard to a given point (vertically or horizontally), by their observing the variable perspective of the circles as seen at different angles. When viewed from the front they appear as circles, from the side as vertical, and from the top as horizontal, ellipses. Their intersections afford additional information as to their position with regard to the observer.

The arrangement so far chosen consists of two vertical glow-lamp circles of different diameters installed behind one another, on the ground, so that an airman will see two concentric circles at the moment when his aeroplane is on or close to the landing ground. By a proper arrangement of the luminous circles (at right angles to the landing ground and at right angles to the landing direction) it is thus possible to give the airman accurate signals as to the direction to be chosen, and as to his distance from the ground.

The airman, in landing, should so control his aeroplane that the two luminous ellipses lying above one another are seen to intersect, in order afterwards to plane down towards them, until the ellipses are slowly changed into circles and, instead of cutting one another, approach the position of concentric circles. At the moment when the small circle is seen inside the larger one, he knows his aeroplane to be only a few metres distant from the ground and may commence landing operations in the direction of the optical signal. By observing the visual angle of the latter, its distance from the observer is readily gauged.

The applications of this optical signal are many: On flying grounds, aerodromes, provisional intermediate landing grounds, &c., it should be installed permanently. During army manœuvres and in warfare, it will be readily carried by the troops, along with the tents, &c., in order, at nightfall, to be used for airmen who are expected to arrive. It will render similar services to the Navy, in connection with waterplanes, and, finally, it may prove of great use in navigation, for signalling the entrance to a harbour, the more so as there is absolutely no risk of confusion with other lights.

ELECTRICAL TREATMENT OF MILK.

TOWARDS the end of 1911 samples of milk, through which continuous current had been passed between tinned copper electrodes, were examined by the City Bacteriologist of Liverpool. It was found that profound changes had been produced in the composition of the milk, but that the only sterilising effect was that due to heating by the heavy current used in some of the tests. Further investigation showed that sterilisation could be produced by unidirectional or slowly alternating current when minute quantities of salt were added to the milk. The electrochemical sterilisation thus produced, though effective in itself, caused such profound changes that milk so treated was spoiled from the consumer's point of view, hence this method had to be abandoned. The effect of static charges of electricity across a moving film of milk formed the basis of the next series of experiments, but no appreciable sterilisation could thus be produced. The effect of a rapidly alternating current was then examined, and thence was evolved the system which has now proved successful. Even in the early stages of work with this method, it was shown that the bacterial content of milk could be reduced to a minimum without appreciable effect on the chemical constitution of the latter.

The sterilising apparatus or lethal tube, designed by Mr. F. C. Lewis (Assistant Lecturer in Bacteriological Methods, Liverpool University), and described by Dr. J. M. Beattie, City Bacteriologist, in a report to the Health Committee, consisted originally of a long tube with three bulbs accommodating copper or other electrodes. The central electrode and the two outer electrodes in parallel were connected to the terminals of a H.T. transformer. The whole apparatus was insulated by glass supports, and milk was passed through the tube from a given height at a known speed. In the latest apparatus, electrode entrances are made separately, as in fig. 1. Copper electrodes are used, and the dimensions of the apparatus permit free passage of milk (without eddies or pools), while ensuring thorough sterilisation of all milk passing through the lethal tube. The separate electrode chambers are connected by suitable lengths of glass tubing with rubber joints (fig. 2, p. 170). The flow of milk can be regulated by the operator, and the outlet connections prevent infection after treatment.

From 140 separate daily tests it appears that bacillus coli and others of this group (nearly always found in milk, and particularly

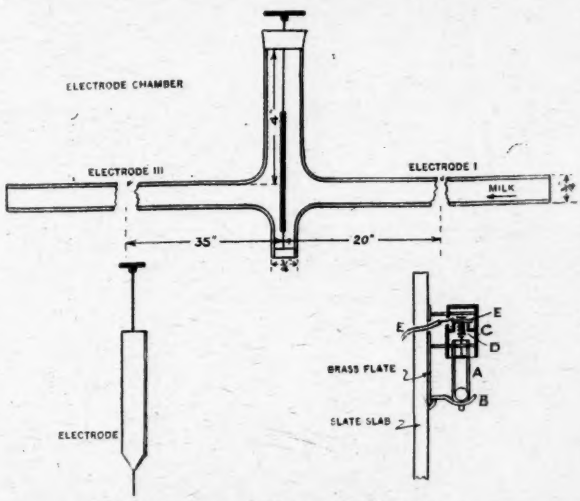


FIG. 1.—DETAILS OF TUBE AND ELECTRODES.

abundant where manurial contamination is present), are completely destroyed, and with them the bacillus of typhoid fever, if ever present. The pus, or abscess-producing bacteria (staphylococci, &c.), are also destroyed, and inoculation experiments show that milk, infected naturally or artificially with the bacillus of tuberculosis, is completely sterilised by high-tension electrical treatment. Bacteria which caused septic poisoning in inoculated animals were also destroyed, or so reduced in number as to render them harmless.

Only in rare instances was the milk rendered absolutely sterile, but it was free from dangerous or disease-producing bacteria and from ordinary milk souring bacteria, while there was over 99 pe

cent. reduction in the number of all other forms of bacterial life. A tumbler of milk merely covered to prevent dust contamination would be quite sweet and drinkable three days after it had been treated, and samples kept absolutely free from air contamination have been found quite palatable after seven or eight days. Reports of chemical examination by Mr. W. H. Roberts, city analyst of Liverpool, show that the chemical composition of milk is unaltered by the treatment described, and that, due to the destruction of acid-forming bacteria, there is retarded increase of acidity and increased keeping power in treated milk. The lactalbumin, which is coagulated in ordinary sterilised milk, is not coagulated in electrically-treated milk, and, in addition, enzymes are not destroyed. Bacteria remaining in the electrically-treated milk have been isolated, and experiments are being conducted to find a means whereby even these can be destroyed economically. They are, however, comparatively few in number, and, as far as can be ascertained, not concerned in the production of disease, hence their presence does not affect the value of the present process for the treatment of milk for infant feeding.

Such satisfactory results were obtained with the experimental equipment (treating 6¾ gallons per hour in a single lethal tube) that a larger plant was installed at the Corporation milk depôt, Earle Road, in 1913. The whole of the milk sent out from this

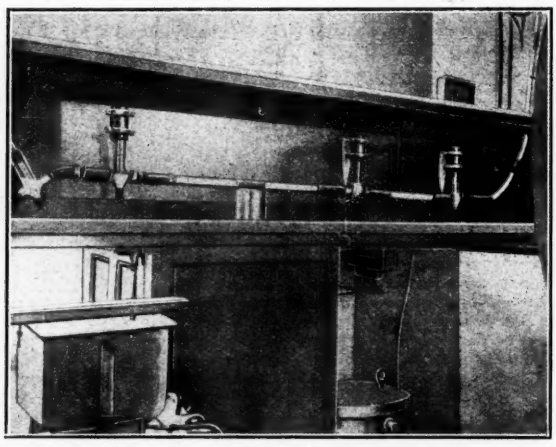


FIG. 2.—LEWIS APPARATUS FOR STERILISING MILK.

depôt and one-third of the Netherfield Road supply is now treated electrically, the transference from heat to electrical sterilisation being made without a day's interruption in the supply.

On the upper floor at Earle Road there is a tank capable of holding the full day's supply of milk and connected to a smaller ball-valve tank. The latter constant-level tank is connected to the lethal tube in the ground-floor room (fig. 2), the flow being maintained by gravity. After leaving the lethal tube (at the left of fig. 2) the milk flows into receiving tanks, whence it passes to bottling apparatus in the basement. During its passage through the lethal tube the milk is subjected to 2·0-2·3 amperes at 3,900-4,200 volts, and is exposed to a maximum temperature of 60·64° C., but for such a few seconds that heating effects can be neglected. The outlet thermometer is clearly visible to the left of fig. 2.

The electrical equipment comprises a D.C.-A.C. motor-generator set in the basement, a high-tension transformer, together with a current transformer, a pressure transformer and the usual switchgear and regulating devices. The transformers are kept in an asbestos-lined, fireproof cupboard below the lethal tube (fig. 2), the lethal tube cupboard is glass-fronted, and the switchboard is placed so as to give the operator control over the whole installa-

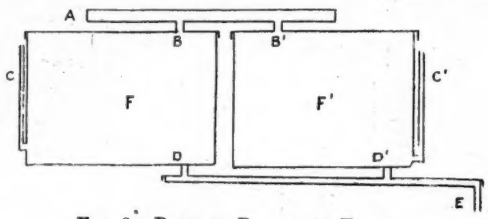


FIG. 3.—PLAN OF RECEIVING TANKS.

tion. The construction of the electrode chamber and its bracket is shown in fig. 1, in which A represents the electrode chamber, B the curved supporting claw (see also fig. 2), C a vulcanite protecting cap, D a helical spring connection, and E the high-tension cable. The vulcanite cap C fits over the chamber A, and a contact disk carried by the spring D bears on the nail head of the tube electrode (see fig. 1, left).

Before and after passing through the lethal tube, the milk passes through earthed aluminium tubes visible to right and left of the first and last electrodes in fig. 2. High-tension shock from the supply and receiving tanks is thus impossible. Switches are so placed that the system cannot be live while the cupboard-doors are open; hence, with ordinary care, there is no danger to the operator.

Soon after the Earle Road apparatus was started, difficulties were met with in "flashing" and charring of the milk. By substituting copper for the aluminium electrodes first used in the large scale plant, the difficulty was overcome. Since, however, flashing (giving a burnt taste to the milk) might occur at the end of a shift, and spoil the whole supply, two small supplementary tanks have been installed. Two small covered tanks, F F¹ (fig. 3) are fitted with gauge glasses, C C¹, and their inlets B B¹ connected by an open channel A, and their outlets D D¹ by a covered channel discharging to the main receiving tank. When tank F has been filled, the delivery tube from the lethal tube is transferred to tank F¹, a small quantity of milk being meanwhile collected in the testing trough A. This milk is tested, and if it is found that all the electrodes are working satisfactorily, and flashing not occurring, tank F can be emptied into the main tank, and so on.

The quantity of diluted milk handled daily at Earle Road is from 100 to 125 gallons, and this amount has to be distributed in about 3,000 bottles. To eliminate recontamination of sterilised milk, the shape of bottle has been altered to facilitate cleaning, and ordinary corks are now used instead of complicated spring and rubber stoppers, which were undoubtedly a source of contamination. Further to reduce opportunities for contamination, a much simpler filling apparatus has been brought into use.

The conclusions to be drawn from the work carried out at Liverpool are:—That the electrical treatment practised is a commercially practicable method of reducing the total number of bacteria in milk by 99·93 per cent., and of destroying all disease-producing bacteria originally present. No appreciable number of milk-souring bacteria escape destruction, and milk will keep perfectly sweet for three or four days after treatment (longer if protected from after-contamination). The chemical composition and taste of the milk are unaffected, so that, from this point of view, the description "raw milk" is accurately applicable. Milk treated by the Lewis process is claimed to be perfectly satisfactory as a food for infants, and as nearly sterile as appears to be necessary or advantageous.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Mazda Lamps.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House 77, Upper Thames Street, E.C., have issued a new price list covering the complete range of Mazda drawn-wire automobile, battery and flashlight lamps. This list includes in the automobile

FIG. 1.

FIG. 2.

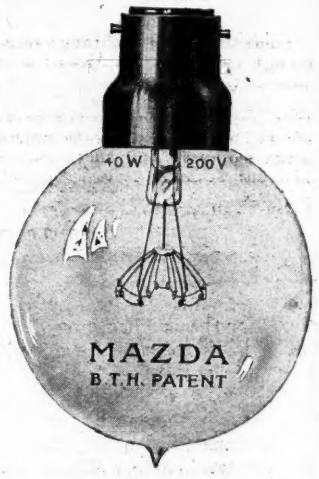


FIG. 3.

FIG. 1.—MAZDA LAMP FOR MINERS' LANTERN.
FIG. 2.—PLAN OF "MERIDIAN" LAMP FILAMENT.
FIG. 3.—MAZDA "MERIDIAN" LAMP.

section, headlight, sidelight, tail-light and steering pillar light lamps, and domelight, festoon and tubular lamps for interior lighting. A noteworthy feature is the inclusion of a full list of specially capped headlight, sidelight, and tail-light lamps for American cars.

The list also contains particulars of a number of miscellaneous types for battery service, such as motor-'bus lamps, common battery lamps, illumination lamps and flashlight lamps. The list prices of the last-mentioned lamps have just been considerably reduced. Fig. 1 shows a miners' lamp with a special taper shell peg cap. Another type, which should have many useful applications, is the Mazda "Meridian" lamp, illustrated in fig. 3. This has the filament, of drawn tungsten wire, wound in a very close spiral, and mounted in the horizontal plane so as to throw the light downwards. A close-fitting opal reflector can be supplied which helps to concentrate the light in the downward direction. Fig. 2 shows the star-shaped filament in plan.

Explosion-Proof Circuit-Breakers with Instruments.

In a new range of explosion-proof circuit-breakers recently introduced by the GENERAL ELECTRIC CO., of 67, Queen Victoria Street, E.C., provision is made for attaching an explosion-proof pedestal type instrument which is provided with long well-machined flanges to give the metal-to-metal joints similar to those between the circuit-breaker lid and box. The covers of these

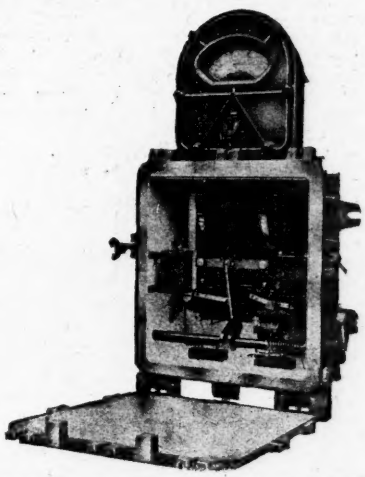


FIG. 4.—G.E.C. EXPLOSION-PROOF CIRCUIT-BREAKER (OPEN) WITH EXPLOSION-PROOF AMMETER ATTACHMENT.

attachments are strongly bolted on, in order to resist the effects of any internal explosion, and the strong plate-glass window has wire netting embedded in it, which, in addition to strengthening the glass, holds the pieces together in the event of breakage. The inclusion of such an attachment in explosion-proof circuit-breakers permits the connections between the ammeter and the circuit-breaker to be neatly arranged.

New Transformer.

We have received from the GES. FUR ELEKTRISCHE INDUSTRIE, of Vienna, particulars of some new type transformers with cooling ribs, which are manufactured by them. The construction adopted is claimed to give very effective cooling, and consists of the assembly with the coils of aluminium plates, $\frac{1}{50}$ in. thick, coated with black heat-absorbing paint.

The transformer core, built up of wrought-iron sheets, also has the cooling rib contruction at the corners.

Fig. 5 shows a 5·5-K.V.A. 110/500-volt tranformer, which, we gather, with an average temperature rise of 47·5°, developed 6·82 K.V.A. with the ribs, and 3·35 K.V.A. without them, the ratio of

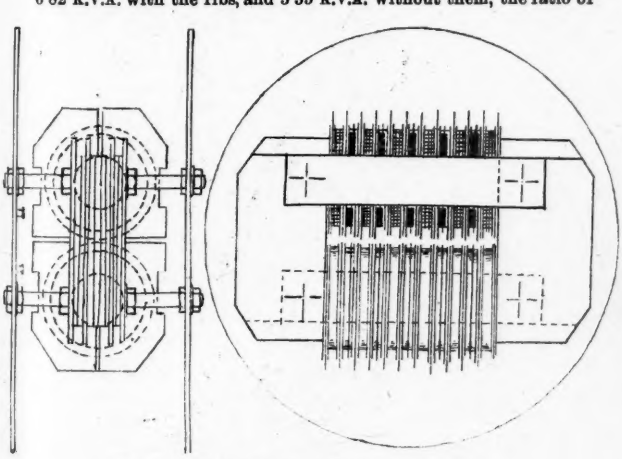


FIG. 5.—TRANSFORMER WITH COOLING RIBS.

copper and iron losses remaining constant during the two tests. The use of radiating ribs is claimed to result in uniform heating in all parts of the transformer, and to avoid cases where coils are burnt out, although the temperature at the level of the oil appears to be quite satisfactory.

B.T.H. Railway Motors.

By the courtesy of the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, we are enabled to give the following particulars of the direct interpole ventilated railway motors which they are at present building at their Rugby works for the Central Argentine Railway. These motors are for use on an 850-volt D.C. system, and are rated at 250 H.P. each; they are arranged for tapped field control, enabling speeds up to 65 miles per hour to be obtained. Efficient ventilation is provided by a fan attached to the armature shaft, which draws air through a screened inlet over the armature and back through longitudinal ducts in the core, ensuring uniform removal of heat and the elimination of hot spots. In this way the radial ducts, which are used in the ordinary type of armature, are eliminated, making it possible to build a much tighter core and completely to protect the armature coils on the under side. The armature coils are insulated with mica, this material being used wherever possible throughout the motor. The field windings consist of copper strip insulated with asbestos and impregnated, any movement or chafing being effectually prevented by spring flanges which hold the coils in position. All the external leads

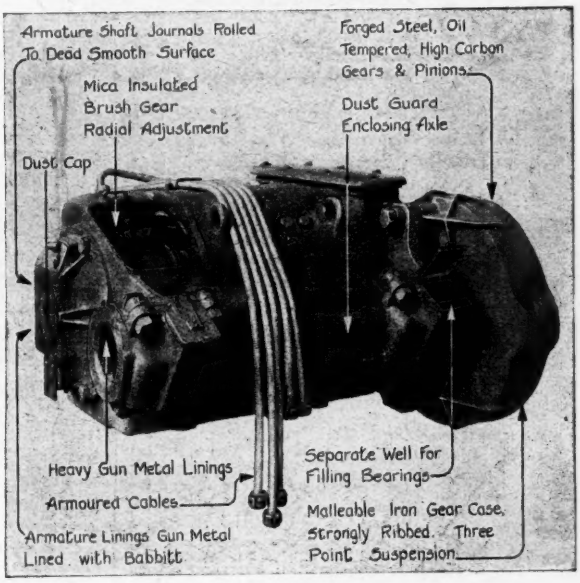

Armature Shaft Journals Rolled To Dead Smooth Surface
Forged Steel, Oil Tempered, High Carbon Gears & Pinions
Mica Insulated Brush Gear Radial Adjustment
Dust Guard Enclosing Axle
Dust Cap
Heavy Gun Metal Linings
Armoured Cables
Armature Linings Gun Metal Lined with Babbitt
Separate Well for Filling Bearings
Malleable Iron Gear Case, Strongly Ribbed. Three Point Suspension

FIG. 6.—B.T.H. 250-H.P. RAILWAY MOTOR.

from the motors are encased in flexible metallic tubing, which effectively protects the insulation from injury. The axle bearings are fitted with heavy gun-metal linings, and the armature bearings are of gun-metal lined with Babbitt. That part of the axle between the bearings is enclosed by a dust-guard, a dust-cap being also fitted to the armature shaft bearing at the commutator end, so that all access of dust to the bearings is prevented. The gear case is of malleable iron, strongly ribbed to enable it to withstand heavy shocks, and arranged for three-point suspension, the gears and pinions being of high-carbon oil-tempered forged steel.

All parts of the motors are subjected to stringent tests at various stages during their manufacture, and each completed motor is

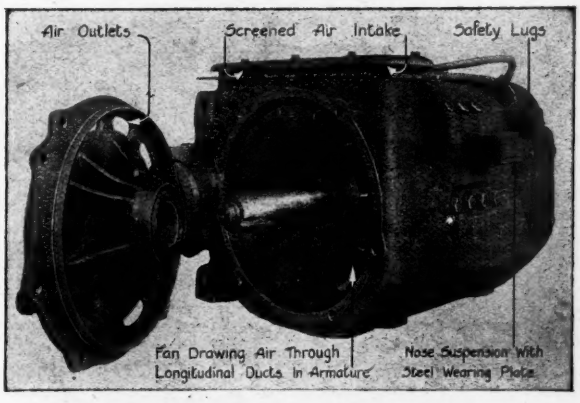

Air Outlets
Screened Air Intake
Safety Lugs
Fan Drawing Air Through Longitudinal Ducts in Armature
Nose Suspension with Steel Wearing Plate

FIG. 7.—MOTOR WITH END COVER REMOVED, SHOWING FAN.

thoroughly tested to ascertain that its performance agrees with the requirements of the original design, readings being taken of efficiency, temperature rise on load, &c. The insulation is subjected to high potential tests calculated to show up the slightest defects.

"Altior" Process of Die Casting.

A novel form of automatic die-casting machine is just being perfected by NATIONAL ALLOYS, LTD., Ilford, London, E., with the object of die-casting light aluminium alloys, of specific gravity 2·85. It is also adapted for die-casting other non-ferrous alloys, such as Babbitt's metal, zinc alloys, &c.

A furnace with the necessary crucible to contain the molten metal forms the base of the machine. Bolted to this is a neck piece with a domed cover, near the centre of which is formed a

pocket, having screwed into it a circular block of specially hard metal, bored out to form a taper nozzle, and slotted to take the sprue-cutting bar. In this pocket and around the taper nozzle is a small furnace which keeps the metal perfectly molten right up to the time of entering the die. Held in place by means of a gland and stuffing box on the under side of the nozzle is a tube of refractory material which passes down through the molten metal to within about half-an-inch from the bottom of the crucible. Through a gland in the domed cover a spindle runs down into the crucible, carrying two perforated disks, which are plunged up and down in the molten metal by means of a hand lever, thus keeping the metal well agitated. A hole and cover for same is also placed in the domed cover to allow of the crucible being filled without removing the cover. Hinged to the domed cover is a plate to which is fixed the bottom half of the die to be cast from, and having in the centre a hole to register exactly with the nozzle before mentioned in the circular block of hard metal, and also with the filling hole

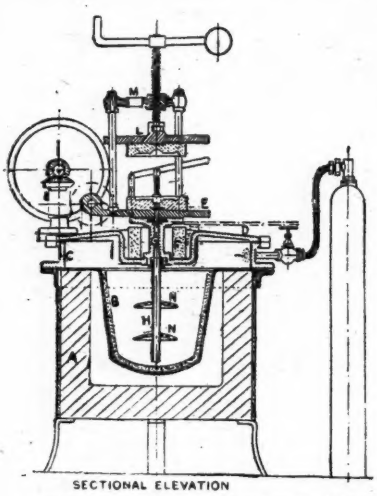
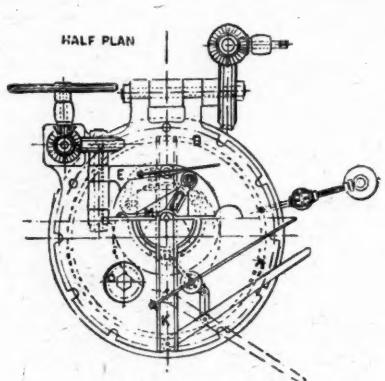


FIG. 8.—SECTIONAL VIEW, DIE-CASTING MACHINE.

in the bottom half of the die. The hinged plate referred to is tilted back into any desired position by means of a suitable bevel and worm gear. Screwed into the hinged plate are three bright mild steel pillars carrying a bridge piece, through the centre of which works a double-threaded quick-running screw, operated by a heavy hand-wheel or cross-bar at the top, and carrying at the other end a plate registering on the three bright pillars referred to. This plate carries the top half of the die. The domed cover,



A.	Furnace.	H	Refractory Tube
B.	Crucible.	K	Sprue Cutting Bar
C	C.I. Neck Piece	L	Top Die Plate
D.	Domed Cover	M	Bridge Piece
E.	Bottom Die Plate	N	Mixing Discs
F.	Small Furnace	O	Filling Hole
G.	Hard Metal Nozzle.		

FIG. 9.—ARRANGEMENT OF DIE-CASTING MACHINE IN PLAN.

together with the centre tube agitating disks and all the top gear, is capable of being thrown back by means of a worm gear, thus allowing the crucible to be readily got at.

The metal to be melted is placed in the crucible through the filling hole before described. The furnace is lighted, the bottom half of the die is fixed to the hinged plate, and the top half to the plate carried by the quick-running screw. This is now run down so that the top and bottom halves of the die are brought tightly together (multiple-part dies can also be used). The sprue-cutting bar is put into position so that the molten metal cannot pass through the nozzle, and the hinged plate is clamped down. Connected to the neck piece is a cylinder of liquified gas, the valve controlling which is now opened, allowing the gas to exert pressure on the top of the molten metal in the crucible. The sprue-cutting bar is then pulled back, thereby allowing the metal to be forced up into the die. The sprue-cutting bar is now pulled back again, thereby stopping any further flow of metal, the hinged plate is unclamped, and the whole of the top gear is thrown back by means of the bevel and worm gear, on to a suitable table; the top half of the die is pulled up by means of the screw, and the casting is automatically knocked out by means of three rods carried on the bridge piece. The process is then repeated It will be noticed that the dies are kept at the most suitable temperature for casting, owing to their being directly in conjunction with the small furnace, while at the same time no flames come into direct contact with the metal, thus avoiding oxidation.

The machine illustrated will take dies up to 9 in. sq., and machines to take dies considerably larger are being designed.

Comparatively few machines have been brought out to deal with alloys containing a large percentage of pure aluminium, owing to the fact that aluminium attacks wrought-iron or steel when molten, and also shrinks and cracks during the process of solidification in the die. The alloy used in this machine is Ivanium, which contains no zinc, and is guaranteed not to disintegrate; it has a tensile strength of 12 tons per sq. in., and 6 per cent. elongation in 2 in., and is not affected by sea water or atmospheric conditions. The National Alloys, Ltd., will not be in a position to use the machine for commercial purposes for some weeks, but will then be able to deal with orders for light aluminium and other non-ferrous die castings. We understand that the firm is prepared to enter into negotiations with responsible firms with a view to taking up the rights of this machine.

"Bee" Suction Cleaner.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109, New Oxford Street, W.C., have recently introduced a very moderately priced electric suction cleaner—the "Bee"—model F, which we illustrate in fig. 10.

The motor is of the horizontal universal type, suited for either A.C. or D.C. circuits and rated at 75 watts only. The cleaner

FIG. 10.—"BEE" SUCTION CLEANER.

runs on three wheels, and the rear one is adjustable to place the nozzle in its most efficient operating position; a brush attachment is provided in the nozzle for picking up threads. The dust bag is dust proof, and the usual accessories are supplied for either suction or blowing purposes.

A New Tower Ladder.

For attention to overhead tramway wires the tower ladder illustrated in fig. 11 is a great convenience. It was designed by Mr. Heathman, the tower ladder maker of Parson's Green, London,

for use at Bexley Heath. It has the advantage of being able to travel upon ordinary roads as well as the rails, and is fitted with a connecting rod for coupling to a tramcar. The construction is well braced, and brakes are fitted to the road wheels as well as to the

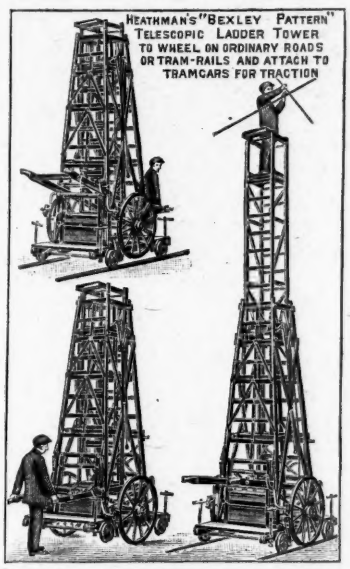


FIG. 11.—NEW TYPE TOWER LADDER.

tram wheels, with plumbing screws to raise the ladder upright when being used upon a hill. The sliding section adjusts at various heights and has a protecting guard rail, as also a tool tray.

Self-Contained Electric Fountain.

MESSRS. LAING, WHARTON, LTD., of 7, Great Newport Street, W.C., are introducing a new self-contained electric fountain—the Whardown—which is fitted with a universal motor, so that it is available for use on either A.C. or D.C. circuits of 100 to 250 volts, by connecting to lampholder or wall socket. The motor is former wound, with a two years' guarantee, and has a rating of 22 watts.

FIG. 12.—SELF-CONTAINED FOUNTAIN.

A special feature is the fitting of the upper glass basin, jet ring and filter to the fountain. The jet-ring piping connection is a push fit only, so that it can be readily removed and the basin taken off for cleaning, and the filter pulled out. The ribbed-glass basin is 13 in. in diameter, and the casing is of Sheffield electro-plate.

New Weatherproof Fuse-Box.

MESSRS. TURNERS & MANVILLE, LTD, of 5, Lloyd's Avenue, E.C., have introduced a new "Noark" weatherproof fuse-box for overhead wire protection. This device is designed to meet the demand for a small, compact and inexpensive two-pole weatherproof box for mounting on cross-arms, and to serve as a fuse between the overhead mains and house service wires, although its application is not limited to this specific purpose. The interior fittings consist of a standard 'Noark" two-pole porcelain fuse block for fuses up to 60 amperes. The enclosing case is of novel construction, forming a thoroughly practical and satisfactory gasketless weatherproof box. The box, which measures $6\frac{7}{16}$ in. × $4\frac{5}{16}$ in. × $2\frac{7}{16}$ in., is cast with a deep rectangular groove extending round three sides, but open at the bottom. In the groove a heavy sliding sheet-metal cover is assembled, which is prevented from complete disengagement by a stop-screw threaded into the cover. This cover is held in a closed position by means of a spring bronze latch which engages in a slot on the cover. The total weight of the box complete, with bracket arm attachment, is $6\frac{1}{4}$ lb.

New Type Current Transformers.

In our issue of July 17th, page 117, we referred to a new type of current transformer which has been introduced by Messrs. Vedovelli, Priestley & Co., Ltd., of Paris—whose agents in this country are MESSRS. LAING, WHARTON, LTD.—and pointed out that these had been constructed for pressures up to 5,000 volts; we understand, however, that this is understating the case, as such transformers have been built for pressures of 50,000 volts, and will shortly be available for more than double that pressure.

LEGAL.

ELECTRIC COMPANY AND LOCAL AUTHORITIES IN JAMAICA.

THE Lords of the Judicial Committee of the Privy Council have given a considered judgment in an appeal by the West India Electric Co., Ltd., against an order of the Supreme Court of Jamaica, in favour of the respondents, the Mayor and Council of Kingston.

LORD SUMNER, delivering the judgment of the Board, said that on June 28th, 1912, the Corporation of Kingston, Jamaica, issued a plaint in the Kingston Court for assessment of compensation to be paid for taking a small portion of Oxford Peu, a piece of land belonging to the appellants. Thereupon the appellants began the present action, in which they claimed an injunction to restrain the respondents from acquiring the site in question, and from proceeding further with the plaint. The hearing of the summons for an interim injunction was, by consent, treated as the trial of the cause, and the action was dismissed. An appeal was unsuccessfully taken, and the case came before their Lordships on appeal from the Supreme Court of Jamaica.

The substantial question on appeal was whether the appellants had any compulsory powers of taking the site in question if they had chosen to exercise them. They were of opinion that the appellants had failed to establish this. It followed that their Lordships were of opinion that the order appealed from was right, and they would accordingly advise His Majesty that this appeal should be dismissed, with costs.

ENGAGING A FOREMAN.

IN the Marylebone County Court, on Thursday last week, before his Honour Sir W. Lucius Selfe, Albert Edward Short, an electrical engineer, sued Messrs. Watson, Marsh & Co., Ltd., of Brondesbury, for £2 10s., being a week's salary.

MR. ARMITAGE, solicitor for the plaintiff, said that, in answer to an advertisement in the ELECTRICAL REVIEW, the plaintiff got into communication with the defendants, and had an interview with them on May 23rd last. They stipulated that he should not make any advance on the salary offered, £2 10s., and, on condition that he was content to remain on at that sum, they would engage him as foreman. He agreed that he should remain at that weekly wage till September, when he would have proved his worth. He was to start on June 8th, but on May 27th he received a letter from the defendants telling him that they did not require his services.

MR. MARSH, one of the defendants, said they had selected six out of the large number of replies they had received in answer to their advertisement—plaintiff's was one of the six. They were satisfied with his testimonials, and told him to call again on the 27th. Subsequently they decided, as plaintiff would not work with satisfaction, not to engage him, and they wrote to him to that effect. In answer to this intimation they received a letter from the plaintiff, in which he acknowledged that nothing definite had been settled.

In view of this admission, his HONOUR gave judgment for the defendants, without costs.

ACCIDENT CLAIM.

AT the Halifax County Court last week, before his Honour Judge McCarthy, Thomas Braithwaite claimed £9 from the Halifax Corporation for damages due to alleged negligence.

It appeared from the evidence that on March 5th the claimant boarded a tramcar, and the vehicle set off at a high speed, and then suddenly stopped, owing to the application of the electric brake. He was thrown to the far end of the car and sustained injuries to the knee and shin, and also had his wrist injured.

The Corporation maintained that there was no negligence, as the car was proceeding at a proper speed, and the milk cart came out of a side road on the wrong side. The driver had applied the electric brake in order to save a collision.

His Honour gave judgment for the defendants with costs, stating that there did not appear to have been any negligence on the part of the driver, and the real action lay against the driver of the milk cart.

E

Roberts Bros. *v.* Howarth.

At the Leigh County Court last week, before his Honour Judge Stanger, K.C., Roberts Bros., electricians, of Silk Street, Leigh, claimed £4 2s. 6d. from Ellis Howarth for electric fittings.

The case for the plaintiffs was that in June of 1911, the defendant entered into an agreement with a Mr. Makinson to purchase a house which was to be built in Beech Walk. When the building was being erected the defendant saw one of Roberts's workmen fitting up electric bells and lights. He told the workman he desired special plugs put in, as he might desire to have radiators attached. The workman promised to mention the matter to his employers, and the latter instructed the workman to proceed with the work. Subsequently, after the work was completed, the defendant decided not to buy the house, and denied that he ever gave the order for the electrical work.

Judgment was given for the plaintiffs, with costs.

Bourne *v.* South Staffordshire Tramways Co.

At Birmingham Assizes, on Friday, before Mr. Justice Scrutton, William Bourne, nut and bolt worker, of Smethwick, was awarded £175 damages against the South Staffordshire Tramways Co., for injuries received through the negligence of the defendants' servants. Plaintiff was a passenger in a tramcar from Birmingham to Smethwick. The driver applied the emergency brake to prevent a collision with another car in front; the car jerked violently, the floor-boards heaved up, and a large iron bar was forced into the car. Plaintiff sustained a fracture of the right ankle, and had not been able to work since December 13th, the date of the accident. The defence was that a defect had arisen in the suspension-bar, which had not been used for years, and which showed no signs of being defective.

Hastings Dolter Surface-Contact Tramways.

At Hastings, on July 23rd, the Hastings Tramway Co. were defendants in a summons charging them with unlawfully using the Dolter surface-contact system from January 1st to March 19th. According to the *Daily Telegraph* report Dr. Ginsburg, who appeared for the Board of Trade, said that the tramways company had notice to discontinue, but did not do so, and the Board received complaints. Further representation from the Board brought a reply that the studs were no longer alive. For the defence it was urged that another system had been utilised as quickly as possible.

The Bench imposed a fine of £5 and costs.

Underground Electric Railways *v.* F. W. Dunkley, Ltd.

In the Chancery Division, Mr. Justice Astbury decided this action which was brought by the Underground Electric Railways Co. of London, Ltd., against F. W. Dunkley, Ltd. (in liquidation) and the first and second mortgage debenture-holders of F. W. Dunkley, Ltd., claiming a declaration that the railway company was entitled to a first charge on the benefits conferred on Frank Wm. Dunkley, by an agreement of November 26th, 1910, in priority to the interest therein of the debenture-holders of F. W. Dunkley, Ltd. The case had reference to the buildings over the Tube Station in Leicester Square. Mr. Dunkley erected above the first floor a block of buildings, and the railway company granted him a lease of 99 years, at £500 a year. The plaintiff company, also by instalments, advanced to the lessee £7,300 at 6 per cent., the moneys to be a first charge on the interest of the lessee.

His Lordship held that, in order to postpone the plaintiff company's claim to the debenture-holders, the plaintiff company must have had notice that Dunkley had parted with his interest in the property, which he had agreed should be charged to the plaintiff company, and the defendants, on whom was the onus, had not proved that such notice was given or received prior to the plaintiff company making the last advance. The plaintiff company was, therefore, entitled to the priority it claimed, and his Lordship made an order accordingly, and gave leave to the defendants to apply for an order for the sale of the property.

Marconi's Wireless Telegraph Co., Ltd., *v.* Helsby Wireless Telegraph Co., Ltd.

Judgment was given by Mr. Justice Eve in the Chancery Division on July 24th in the action for alleged infringement brought by Mr. G. Marconi and Marconi's Wireless Telegraph Co., Ltd., against the Helsby Wireless Telegraph Co., Ltd., which was recently before his Lordship and an assessor (Prof. Bertram Hopkinson).

His Lordship said this action was commenced on October 18th, 1912. At that date, and down to their expiry on April 25th last, the plaintiffs were the owners of Letters Patent No. 7,777, of 1900, for an invention of "Improvements in apparatus for wireless telegraphy." They allege that the defendants infringed the said letters patent in 1911 by the construction and installation of an apparatus on board four steamships belonging to the London and North-Western Railway Co. The defendants deny that they have infringed; and they allege that the letters patent are invalid by reason of certain prior publications; and on these two issues the case has been tried. The area of conflict has been considerably curtailed, and the points in conflict greatly reduced by the fact that in 1911 the letters patent upon which the plaintiffs are suing were construed; and many of the objections raised by the defendants in their pleadings here were dealt with by Lord Parker (then Mr. Justice Parker) in an action brought by the plaintiffs against other defendants. The apparatus used by the defendants in that action was held to be an infringement of the plaintiffs' patent; and it is admitted that the apparatus complained of in this action is for electrical purposes identical with the apparatus so held to be an infringement, except for the introduction into the primary circuit of two additional spark gaps and a through charging coil—but as the presence of the coil is consequent on the introduction of the two spark gaps, there is nothing substantial in that (see Questions and Answers, Nos. 2,457 to 2,461). The short point, therefore, on the issue of infringement which I have to decide, is whether, by the introduction of the two spark gaps, the defendants have produced an apparatus which does not come within the scope of the plaintiffs' patent. The object of the two additional spark gaps is the reduction of the length of the primary wave train; and that they do bring about some reduction is, in my opinion, established by the evidence. Indeed, that such is the case is not disputed by the plaintiffs; it is mainly a question of degree. The defendants put forward and rely on the exhibit "J.S., 9" as demonstrating diagrammatically the reduced length of the primary wave train consequent on the introduction of the spark gaps; and they insist that optical experiments go to confirm the accuracy of the photographic material which form the basis of that diagram. In estimating the credibility to be attached to "J.S., 9"—that is to say, in considering how nearly it approaches to an exact representation of facts, one has to give weight not only to the obvious physical difficulties of accurately reproducing by photography phenomena, the duration of the existence of which is measured by millionths of a second, and the agencies employed in the reproduction; that is to say, such things as the sensitiveness of the photographic plate, and the actinic value of the metal constituting the spark gaps, but also the following facts admitted or proved in the course of the trial:—(1) That the defendants' installation works satisfactorily over the requisite distances; (2) that it is not wasteful of energy; (3) that the coupling of the two circuits is a loose one, in the neighbourhood of 2 per cent., and certainly not exceeding 5 per cent.; (4) that with loose coupling the transfer of energy must be in small doses, something like 3 per cent. per oscillation; and (5) that substantially the whole of the energy in the primary has been, in fact, transferred to the secondary in the defendants' apparatus when the primary has ceased to oscillate. The conclusion to which a consideration of these matters has led me, is that "J.S., 9" cannot be accepted as quantitatively reliable. The alternative of accepting it as accurate leaves one face to face with more than one problem, to which I cannot find a satisfactory answer in the defendants' evidence. For example:—(1) How can a large proportion of the energy be tranferred from primary to secondary in 3½ oscillations with a coupling of less than 5 per cent.? (2) if only that percentage of the energy which corresponds to this coupling is transferred, how can the defendants' apparatus be either efficient or non-wasteful? And (3) If the whole of the energy is not transferred, what becomes of it? But, as I have already stated, I am satisfied that the presence of the spark-gaps does substantially reduce the length of the primary wave train; and that after the primary has ceased oscillating the secondary continues to oscillate for a number of periods, and to radiate the pure wave of the aerial. The defendants claim that the result of this is to improve the working of the installation, in that the cutting off or shutting down of the primary eliminates what has been called the double-humped curve produced when surplus energy is returned from the secondary to the primary, as it can be when the primary is persistently oscillating while the secondary is radiating. I think this may be the case; but I do not think it affects the real question which I have to answer. I think that question may be thus stated. Is it an essential feature of Marconi's invention that the primary should oscillate so that as energy is radiated by the aerial the primary will persistently replenish the secondary with at least an equivalent amount of energy, and thereby maintain the radiating secondary? I do not think it is. In both the plaintiffs' and the defendants' installations, the primary oscillations die down before the secondary oscillations are finished; and in this sense the question resolves itself into one of degree, dependent largely on the character of the radiation employed. With a good radiator radiating in a single swing a very large percentage of the energy transferred, the oscillations of the secondary must die down very quickly after those of the primary have died down; and in such an installation the primary may well be said not only to build up oscillations in the secondary, but thereafter to maintain them, and to be in the true sense the reservoir on which the secondary is persistently drawing for energy to replace that which is being contemporaneously radiated. But with radiators of, what I may perhaps call, more conservative capacities, the necessity for persistent maintenance is proportionately reduced; and although when such radiators are employed, the function of the primary is perhaps rather to build up than to maintain the secondary oscillations, it nevertheless does, in fact, both build them up and maintain them. The defendants rely greatly on those passages in Lord Parker's judgment, wherein they claim that he expressly treats the maintenance of the secondary oscillations by the persistent primary oscillations as of the essence of the invention; but these passages must be read in relation to the particular infringement with which the Court was then dealing; and in my opinion they are not equivalent to a construction of the patent which would have precluded the patentee from claiming protection for installations embodying radiators in which the oscillations could be built up and maintained without the necessity of keeping the primary persistently oscillating. I think, notwithstanding the great ability which has been displayed in endeavouring to lead me to a different conclusion, that the defendants have in substance appropriated the invention described

in the plaintiffs' letters patent; and that in the construction of their apparatus they have only introduced such modifications as are within Marconi's specification, and covered by his claim. I hold, therefore, that their apparatus was an infringement of the plaintiffs' patent. This conclusion disposes of the defendants' suggestion that their apparatus is figure 4 of Lodge's specification of 1897; but with regard to that figure, and the working of the apparatus there depicted, I am advised by the Assessor—whose valuable assistance throughout I take this opportunity of acknowledging—that Mr. Swinburne's evidence—illustrated in "J.S. 16"—is to be preferred to that of Dr. Erskine Murray. It is possible that Lodge made an invention when he suggested, in connection with figure 4, that he would charge the aerial, and would then cut it off from the charging agent as rapidly as possible, leaving it free to swing independently; and the defendants may have taken this invention; but even so, that does not mean that they have not also taken Marconi's invention, which relates to the nature of the charging agent; and can quite well be combined with Lodge's invention. I do not think it is necessary to dwell at length on that part of the case which is concerned with the alleged prior publications. In my opinion, no evidence has been adduced in this case which qualifies in any way the conclusions at which Lord Parker arrived upon the question of Tesla's alleged anticipations. Nor, as a matter of construction, do I think that the passage on page 45 of the documents referred to in the Particulars of Objections, where the use by Ducretet of the Oudin resonator is dealt with, refers to anything else than a user for the purpose of tuning transmitter and receiver; and, as Dr. Erskine Murray admits, the passage on page 51 covers the same ground only. His evidence on this alleged anticipation is well summed up on page 243 of the Notes, where on Question 2,947 he is asked: "Aye or no do you suggest this taught the world the Marconi invention"? And he replies: "I say it might teach the world—but there is always the teacher and the taught." That is not the sort of evidence on which I should be justified in holding that these passages relied on by the defendants disclose an anticipation; and I decline so to do. In my opinion the plaintiffs are right. They are entitled to a declaration that the defendants' apparatus was, at the date of the writ, and thereafter down to April 25th last continued, an infringement of the Letters Patent No. 7,777 of the year 1900; to an inquiry as to the damages sustained by them in consequence of such infringement; and to the costs of the action down to and including this judgment, to be taxed as between solicitor and client. The subsequent costs will be reserved, and there will be liberty to apply.

The British Thomson-Houston Co., Ltd., *v.* Union Electric Lighting Co.

This patent action came before Mr. Justice Sargant, in the Chancery Division, on Monday, July 27th, on a motion for judgment in default of defence.

By the statement of claim the plaintiffs asked for the ordinary relief in a patent action, and the minutes of the order now asked for were in common form, including a direction that the defendants should within 14 days make a statement on oath as to what lamps they had in their possession manufactured in accordance with the patent.

His Lordship made the order in accordance with the minutes as drawn.

The King *v* Landlord: Distraint on Electrical Contractor.

In the Bow County Court, on Monday, before his Honour Judge Smyly, K.C., an interesting interpleader action was heard, in which the Postmaster-General had obtained judgment against Mr. Arnold, an electrical contractor, of the Midland Railway Arches, Woodgrange Road, Forest Gate. When a distress was levied, the landlords, the Tottenham and Forest Gate Railway Co., stepped in and claimed priority as landlords. The debt was for unpaid telephone calls.

Mr. Allsopp appeared for the landlords, and Mr. Davis for the Postmaster-General, who said the whole case turned on the legal question as to who had priority, the King or the landlord. A sum of money was owing to the Postmaster-General for telephone calls, and he also believed it to be true that some £8 15s. was owing for rent.

Mr. Bassett (agent for the landlord) said they levied on June 20th.

Mr. Davis: And we were there on the 18th.

Mr. Bassett: We were not aware of that.

Judge Smyly: Was sufficient seized?

The High Bailiff: There was not sufficient to pay either; I seized all the goods and the sale realised £5 7s. 6d., which has been lodged in Court.

Mr. Davis said his case rested on the decision in Rex *v.* Wells and Allnutt, determining a preference in favour of the King. It said that where the interests of the Crown and the subject were in conflict, the King should have the preference.

Judge Smyly: I should not have the least doubt as to that, except for the late Statute, which gives the landlord priority. It is a question whether the Crown is mentioned in that, and if it is not, whether the Crown is bound by it.

Mr. Davis: I have gone thoroughly through the Act, and can find nothing as to the Crown. I may say there has never been an attempt to limit the prerogative of the King.

Judge Smyly: Except in the English Act of Bankruptcy, Sec. 150, where there is an express exception.

Mr. Davis: And then if there is any question as to the Postmaster-General being the Crown, I have a copy of the Charter here, printed by the King's printers; also, I say it is a matter of common knowledge.

Mr. Allsopp said he was surprised to hear the nature of the defence to his claim. He always thought the King's priority applied to taxes and dues and so on, and not to telephone calls.

Judge Smyly said the authorities showed that the precedence of the King and Crown had been one unbroken line. His verdict would be for the King or Crown, as represented by the Postmaster-General.

Seizure of Lelios Lamps.

In the Shoreditch County Court on Tuesday, before his Honour, Judge Cluer, Geo. Argent, jun., of 133, City Road, E.C., was the claimant in a remarkable interpleader action. Messrs. Nardello and Agarzar, Ltd., of 13, Panton Street, W., agents and importers of electrical fittings and lamps, obtained judgment against Max Wineberg, of 133, City Road, E.C., agent for electrical fittings, and issued execution. Lelios inverted lamps, to the value of £31 16s. 1d., and a £5 typewriter, were seized, but Mr. Argent now claimed them, alleging that he had purchased them from Volt, Ltd., of Holland, as part of a partnership business with Mr. Wineberg. Mr. Louis Green, barrister, appeared for the claimant, and Mr. Clements was counsel for the defence.

Mr. Louis Green said the question of £50 damages for dislocation of business, would arise as the case went on. The facts of the claim were that a partnership was entered into by Argent with Wineberg on February 2nd, 1914, in consequence of an advertisement in the *Daily Telegraph*. At that time the debt was due to the execution creditor, but unknown to the claimant. They traded at 133, City Road, E.C., as M. Watson & Co., ironmongers and agents for electrical goods. Formerly Wineberg had traded at the same address. Under the agreement he brought in £40 in cash to the business and £25 worth of electrical goods. The lamps seized had been purchased from Volt, Ltd., of Holland, direct, and paid for in cash to the carriers. These were in April, £28 8s. 10d. and £28 11s. 2d., and in May £27 2s. 6d., and £14 11s. 10d. He valued the 500 lamps seized at £31 16s. 1d., actual cash paid. All the lamps seized were actually in the invoices produced. The claimant gave evidence, and said that the execution creditors were the sole London agents of Messrs. Volt, Ltd. The partnership had been going along very satisfactorily, and they had been dealing in these Lelios lamps when suddenly Messrs. Nardello & Agarzar said they could have no more until Wineberg's debt was settled up. He pointed out that he had nothing to do with a previous debt of Wineberg's, and also said they were getting lamps from Volt, Ltd. Claimant was told that would be stopped, as they were the sole agents, then judgment was obtained against Wineberg and execution issued. The first he heard of the debt was when he got a letter from Volt's stopping the supplies, and he saw Nardello. In cross-examination, he agreed judgment was obtained on May 19th, execution levied on June 15th, a claim made by him on July 4th, and the partnership agreement was stamped on the 7th. It was quite true that Wineberg had been carrying on business at 133, City Road before the partnership. His bank book and cheques had always been open to inspection. He had never said that Wineberg was simply a traveller in his employ.

Mr. Waterhouse, bank manager, gave evidence as to the opening of the partnership banking account, with the London, City and Midland bank.

For the defence Mr. Grimsdall, the High Bailiff, gave evidence, and said Argent saw him and claimed the goods as his own personal property, never mentioning any partnership. Had he known of it, he would not have gone on, but as he did not prove his claim he went on.

Judge Cluer said it was clearly an honest partnership, or they would not have paid the £10 penalty stamp. The only question was, what had become of the goods? His Honour was told they were sold after notice of the partnership had been given, whereupon he said the execution creditor was liable in damages. All the books and cheques and so on could have been inspected, and the sale ought never to have taken place. It was said they would now have to pay 33 per cent. more for the lamps, and Messrs. Nardello had offered to let them have the original lamps back, as they bought them in at the sale, but how could they on one hand say they were the sole selling agents, and then offer some to the claimant to sell?

Mr. Agarzar gave evidence and said the lamps had been purchased off Volt's on the understanding they were not to be imported into England.

Judge Cluer: What ridiculous rubbish, when Volt's consigned them to Watson's. He was entitled to damage, owing to the serious interference with his business. He assessed the damages at £20, besides the value of the goods seized, £36 16s. 1d., and ordered the execution creditor to pay the High Bailiff's costs.

Strike.—The labour dispute at the Helsby Cable Works was settled last week, and the works were reopened on July 23rd.

PARLIAMENTARY.

Oxford and District Tramways Bill.

On this Bill coming up for third reading in the House of Commons, Mr. E. Harvey moved that the Bill be rejected. It was a Bill to ratify an agreement between the Oxford Electric Tramways Co. and the Oxford Corporation, and he objected to it on the ground that it conferred an entirely novel monopoly on the Tramways Company, viz, that of running an omnibus service for 37 years, while they were relieved of a very serious obligation to reconstruct the tramways under conditions which had been made difficult by changes since the Act of a few years ago.

Viscount Valentia considered that the Bill was favourable to the City of Oxford, and gave no advantages to the Tramways Co.

Mr. J. H. Whiteley said the Bill came before him as chairman of the Unopposed Bill Committee, after the petition had been withdrawn and the City Corporation and the company had come to terms. After the proposals had been carefully examined the Committee unanimously passed the Bill.

The amendment was rejected and the Bill carried a third time.

York Corporation Bill.

On July 22nd and 23rd a Select Committee of the House of Commons, under the chairmanship of Lord Haversham, considered the Bill promoted by the York Corporation, which, amongst other things, asked for powers to provide tramway extensions and to run trolley vehicles and motor-omnibuses. The estimates contained in the Bill were £9,800 for the provision of trolley vehicles; £8,700 for the electrical equipment of trolley vehicles; £12,000 for the provision and equipment of motor-omnibuses; and £21,700 for purchase of land for purposes of a light railway and the erection of buildings, &c.

Mr. Macassey, K.C., and Mr. Beveridge appeared for the promoters, and Mr. Talbot, K.C., Mr. Clode, K.C., and the Hon. E. Charteris represented the North-Eastern Railway Co. to oppose the Bill.

Mr. Macassey explained that the Corporation proposed to run trolley cars on four routes commencing opposite the North-Eastern Railway Station, and the North-Eastern Co. objected to two of these routes on the ground that it was proposed that the vehicles might stop, stand or turn round in front of the station in the company's road, which was maintained by the Corporation at the cost of the company.

Alderman Mayer (Chairman of the Corporation Tramways Committee), Mr. Burrows (Manager of the York Tramways), and Mr. Spencer (Manager of the Bradford Corporation Tramways) gave evidence in support of the Bill.

After hearing further evidence, the Committee passed the preamble of the Bill, but gave the North-Eastern Railway Co. power to appeal to the Board of Trade as to the matter of the turning point at the station for trolley cars and motor vehicles.

Newcastle Corporation Bill.

A Select Committee of the House of Lords, presided over by Lord Haversham, on Monday concluded the hearing of a Bill promoted by the Newcastle Corporation with the object of securing powers to construct and work additional tramways in the urban districts of Longbenton and Weetslade. The Corporation also sought powers under the Bill to run services of motor-omnibuses.

Mr. Honoratus Lloyd, K.C., who opened the case for the promoters, explained that it was proposed to give additional tramway facilities, particularly during the period of race-meetings at Gosforth Park. The only opposition was that of the North-Eastern Railway Co., who objected on the ground of competition.

Evidence for the Bill was given by Mr. W. J. Steel, the city engineer, and Mr. Ernest Hatton, manager of the tramways, the latter remarking that the proposed new tramways would serve a population of 25,000 people.

Mr. J. B. Hamilton, general manager of the Leeds City Tramways, also gave evidence in support of the Bill. He thought there was room both for the railway and the tramways.

Considerable evidence was given on behalf of the North-Eastern Railway Co. in opposition to the Bill, but in the end the Committee found the preamble of the Bill to have been proved.

Light Railways and the Development Bill.—In the House of Commons, Mr. Rowntree asked the President of the Board of Trade whether he was aware that the Attorney-General had advised that it was almost impossible that a light railway constructed and run by a group of private individuals could be constructed and run otherwise than as a commercial, that is a profit-making, concern, with the result that no association of persons or company formed to construct and work a light railway would in practice be found to satisfy the condition of not trading for profit within the meaning of Sec. 1 (1) of The Development and Roads Improvement Funds Act, 1909; and, if so, whether, seeing such opinion rendered the Act entirely inoperative as regarded the construction of light railways by voluntary effort with State aid, he would say what course under these circumstances the Government proposed to adopt.—Mr. Montagu replied that the Development Commission had experienced difficulties owing to the legal interpretation which they were advised must be placed on the Statute referred to, and the whole question was receiving the careful attention of the Government.

Bristol Corporation Tramways Bill.—On July 23rd the Court of Referees of the House of Commons considered the objections of the Bristol Corporation to the Bristol Ratepayers' Association, the West Gloucestershire Water Co., and several private petitioners being heard against its Tramways Bill. Mr. Fitzgerald, for the Corporation, contended that 33,000 electors had voted at the poll taken, and a majority of between 3,000 and 4,000 was in favour of the Corporation purchasing the tramways. The Court disallowed the *locus* to the Ratepayers' Association and the Water Co., but agreed that John Hare and others and Charles Bell and others should be heard before the Committee for considering the Bill.

Glasgow Corporation Bill.—On Wednesday, Thursday and Friday last week a Select Committee of the House of Commons, presided over by Sir Edwin Cornwall, had under consideration the Bill of the Glasgow Corporation under which powers were sought for a new tramway street and a bridge to carry the street over the river Kelvin. After hearing considerable evidence both for and against the proposal, the Committee passed the preamble of the Bill without alteration.

BUSINESS NOTES.

Consular Notes.—CHINA.—In a recent report on the trade of his district, the Austrian Consul at Tientsin gives some interesting advice to his countrymen as to the methods to be adopted in endeavouring to obtain trade in that market. After pointing out that competition in the class of goods in which the Chinese buyer is interested is very keen, he states that in order to do any extensive business in the country in the face of active competition from all parts of the world, it is necessary to bring to bear on the market great energy, care, sacrifice and efficiency. The popular opinion that Chinese business does not entail much exercise of care on the part of the manufacturer or merchant, but that orders can be executed with considerable latitude as to complying with conditions laid down, is far from the truth. If a manufacturer is not prepared to give of his best for the satisfaction of his customer, he had much better leave the market severely alone, otherwise he will only meet with disaster. One can only repeat that in executing business with China all requirements as to quality, packing, delivery, &c., should be carefully followed out, for the manufacturer overseas is not in a position to decide which of the details of the order are of the greatest importance to the taste and desire of the Chinese buyer. It often happens that a departure from the instructions of the buyer, even if such departure appears to the supplier to be advantageous from all points of view, only leads to considerable difficulty in the way of the buyer getting rid of the goods he has ordered, and to friction between buyer and seller. In not a few cases acceptance of delivery is declined, and when the ultimate result is an action between the supplier and customer, the former is apt to experience difficulty in avoiding a loss which a close adherence to the instructions given would have prevented. In attempting to do business in Northern China, it should be borne in mind that, whether for import or export, direct connection with the native firms should be avoided in view of the existing unsatisfactory organisation of native trade. Business must be confined to the foreign firms established on the market, who interest themselves in the importation and exportation of all kinds of goods. The chief among these are of British or German nationality, and, in lesser numbers, American, Belgian, Swiss and Russian. Almost all of these houses operate exclusively through their branches in London, Hamburg, &c. They naturally give a preference to the products of their own country when other things are equal, and are in some cases bound to these countries by agency agreements. It is not always easy, therefore, for a new firm to enter the market, offers of business being met with the reply that the firm concerned is otherwise fixed up for business in the goods concerned. The question then arises how business can be done. The Consul points out that only the best and most strongly-financed firms can hope to succeed in the market in the face of the keen competition of the existing merchants, and suggests that home firms who are strongly desirous of competing should come to an arrangement with one of the large European firms of China merchants for the purpose of establishing under its auspices a branch house in China of the manufacturer concerned. In some cases a number of firms could combine to work out such a scheme, and could, with less cost and more satisfactorily, establish an office in China which would secure enough business to warrant such a departure.

Elsewhere in his report the Consul states that electric lighting plants are to be found in the following towns in his Consular district:—Province of Chihli, Tientsin and Peking; Province of Shantung, Tsinanfu, Tsingtao; Manchuria, Harbin, Antung, Kirin, Newchwang and Dairen.

GREECE.—The Austrian Consul at Salonica reports that under Turkish rule a large number of petrol and benzine motors were in use. Since Greece has taken possession of the town, however, petrol and benzine have been subjected to a tax, so that their use will probably decline. It seems probable, therefore, that many small factories and industries will adopt electric power as an alternative.

NORWAY.—The American Consul at Bergen reports that the Marconi company's trans-Atlantic radiotelegraph station being erected outside the city of Stavanger will be an added facility for business relations between the United States and Norway. The present cable rate from Stavanger to the zone of New York is 1s. 5½d.; the wireless rate will be 1s. per word. The construction of the radio station became assured when in June, 1913, the Norwegian Storthing (Parliament) approved the Marconi contract and appropriated £117,000 towards its erection. The station is expected to be ready for operation by January 1st, 1915. There is said to be no less than 500,000 hydroelectric H.P. available for development in the Stavanger Consular district, besides the many smaller falls already utilised. Movements are now on foot for developing much of this power, the realisation of which will mean a new industrial era for this district.

Elsewhere in his report the Consul states that the installation of a new semi-automatic telephone system, with underground cable, by the Bergens Telefonselskab, is nearing completion, and, when finished, will give to Bergen the most modern and up-to-date system of any city in Scandinavia. The system is American, installed by an American company, which secured the contract after tendering according to plans and specifications furnished by this Consulate. The annual report shows that the receipts from subscribers aggregate £12,750, number of subscribers 4,121. Length of line, 11,905 miles, of which 9,673 miles are cable. The length of ducts for underground cables is 39·5 miles. The new exchange will cost £22,500, and will have a capacity for 15,000 subscribers. The original capital stock of £33,500 has been increased to £67,000.

The project of constructing a railway from the heart of the city of Bergen to the summit of Mount Floien (1,000 ft. high) has been discussed for years, but the great cost of construction and its uncertainty as a business venture have, so far, made it impossible of realisation. Since the building of the Bergen-Christiania mountain railway and the establishment of the Norske-Amerikalinie, the passenger and tourist traffic has increased to such an extent that the plan has become feasible, and, with a view to ensuring its construction, the City Council of Bergen, on December 29th, 1913, appropriated £5,600 to aid in the construction of an electric railway to the summit. A tunnel will be made through Mount Floien, at its base, to connect the new railway terminal with the harbour; the estimated length of the tunnel is 1·86 miles.

The Consul in Christiania has recently endeavoured to ascertain the cost of water-power plants per H.P. in Norway. No statistical data are available, but an interview with the Department of Waterfalls elicited the following information:—The construction cost of water-power plants varies from £5 12s. to £11 2s. per H.P. for large water plants, and from £5 12s. to £28 per H.P. for small plants. The rate at which the power is sold to customers varies from 35s. 4d. for large enterprises up to £2 16s. for small ones per H.P. per year, 24 hours per day service. A small book, published in Norwegian, by Aschekong & Co., 45, Karl Johansgate, Christiania, giving information on the subject, and entitled "Veilygning i Udbygning af Vandfeld, 1913," can be procured at a cost of 2·10 kroner (about 2s. 4d.), which includes postage.

ARGENTINA.—The American Consul at Rosario reports that electric motors are used in Rosario to a considerable extent, those for industrial purposes being chiefly in small plants and workshops. The Sociedad de Electricidad (light and power plant) states that there are 1,200 electric motors in use at Rosario ranging up to 45 H.P. The greatest demand is for small motors of 5 to 7 H.P.

Conditions with respect to voltage, current, prices, &c., are as follows:—Main part of the city, continuous current, 440 volts for motors over 5 H.P. and 220 volts for smaller motors; outer district, three-phase alternating current, 200 volts for motors over 5 H.P. and 110 volts for smaller motors. Rates for motors are as follows:—9·7 cents per KW.-hr. for first 30 KW.-hrs. consumed per month for each horse-power installed; 5.8 cents per KW.-hr. for remainder up to 1,000, and 4.3 cents per KW.-hr. for consumption in excess of 1,000 KW.-hr. per month. The company grants special rates to large consumers, and endeavours through advertising to increase the use of electric motors. It neither owns nor rents motors except those used in its own plant.

While electric motors are used to a considerable extent, it will not be easy to introduce a new line here, as the field is already well worked. Four of the leading manufacturers of electrical appliances, including motors, two American and two German, are represented here or in Buenos Ayres, and have a good hold on the market.

It is hardly likely, in view of the strong competition, that new motors can be introduced here through mere correspondence. Goods which are finding a demand here have been placed on the market through personal efforts of travelling salesmen and agents. Where two articles are in competition, that which is backed by personal effort interested in its success has every advantage over the article which has to depend on catalogue advertising. In case reports from other Consulates in South America lead to the conclusion that it would not be worth while to send out a personal representative to work the field, it might be found advisable to make sales through some New York commission house.

Experience in this territory shows that the distribution of catalogues produces very meagre results, and that goods are seldom ordered from catalogues except where the catalogue has been solicited.

Bankruptcy Proceedings.—TRUBIE MOORE, electrical engineer, Headingley, Leeds.—Receiving order, July 24th, on creditors' petition. First meeting, August 7th, at Official Receiver's office, 24, Bond Street, Leeds; public examination, September 8th, at County Court House, Albion Place, Leeds.

Catalogues and Lists.—MESSRS. CROMPTON & CO., LTD., Arc Works, Chelmsford.—Publication No. P29 (36 pages) in their uniform size and style, giving illustrations and very fully-detailed particulars of the Crompton-Blondel open type flame arc lamps. An advance copy of leaflet No. 538, describing several patterns of enclosed arc lamps, has also been received.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—20-page booklet, entitled "A Few Words to Electrical Contractors on Signs." A number of outdoor and indoor shop electric signs are very neatly illustrated, also some indicator and special signs and illuminated letters. Prices are given, as well as some interesting notes designed to persuade the contractor to push the sign business in his own town.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, London, S.E.—New catalogue of 96 pages (No. 535) containing excellent illustrations and clear price indications, with some brief descriptive particulars, of a considerable range of telephone apparatus. The largest individual section (between 40 and 50 pages) is devoted to telephones and accessories—intercommunication battery telephones, magneto wall and table telephones, central-battery telephones, portable telephones, high-tension telephones, watertight and gas-tight magneto telephones, cables and wires, cells, &c. In the second section various telephone switchboards are included—battery or magneto, magneto, central-battery, &c. Automatic systems, numerous protective devices, condensers, and fire-alarm systems follow, and a telegraphic code completes the catalogue.

MR. GEORGE ELLISON, Victoria Works, Warstone Lane, Birmingham.—Sheets 131/1 to 131/14, illustrating and describing totally enclosed ironclad auto-transformer starting panels for squirrel-cage induction motors. Tabulated particulars are given at great length in regard to the switch ratings under various conditions, prices and code words for telegrams, of the various types, together with accessories and extras, also approximate weights and dimensions.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C.—Handsome brochure with many illustrations, showing their fan works at Witton, which are wholly devoted to the manufacture of "Freezor" fans.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., Telephone House, Tottenham Court Road, W.—Two-page leaflet, No. 229, giving particulars and prices of enamelled-wire telephone cables for interphone systems.

THE ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, E.C.—Leaflet and sample of Armorduct "H.B." cable, which is claimed to occupy a leading position outside Association cable.

MESSRS. KRUPKA & JACOBY, LTD., 39, Victoria Street, S.W.—Leaflet H.C. A1 dealing with heating and cooking apparatus, including electric coffee, tea and water cans, hot-plates, travelling outfits for universal voltage, sterilising apparatus, cookers, cigar lighters, &c.

Welding Plant.—THE SIRIUS AUTOGENOUS WORKS CO., of 85 and 87, High Street, Stratford, E., have secured an order from the Schmidt's Superheating Co., Ltd., for a complete oxy-acetylene welding plant for their new works at Trafford Park, Manchester. The generating plant is of the same capacity as that recently supplied by the company to the British Westinghouse Electric and Manufacturing Co., Ltd., of Manchester, and these will be the two largest automatic acetylene generators in this country.

Holidays.—The OSRAM LAMP WORKS, LTD., Hammersmith, announce the closing of their works from to-morrow, Saturday, August 1st, until Monday morning, August 10th, for the annual holidays. Matters of urgency only will be dealt with.

The works of MESSRS. BELLING & CO. will be closed from August 3rd to 8th inclusive. Correspondence will receive attention.

The ELECTRICAL APPARATUS CO., LTD., notify the closing of their works from August 3rd to 9th inclusive. Matters of urgency will be attended to.

The works of the RUGBY LAMP CO., LTD., will be closed from to-day, July 31st, until August 10th. Urgent matters will receive attention.

RECORD ELECTRICAL CO., LTD.—The Broadheath Works will be closed from 5.30 p.m., on Friday, July 31st, until 7.30 a.m. on Monday, August 10th, 1914. Letters of extreme urgency will receive attention.

EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD.—The Ediswan Works, Ponder's End, and offices will close on Saturday, August 1st, and will re-open on Monday, August 10th. An adequate staff will deal with urgent business during the holidays.

MESSRS. BROWETT, LINDLEY & CO., LTD.—The works will be closed from Saturday, August 1st to Saturday, August 8th, both days inclusive. A small staff will be in attendance to deal with urgent correspondence.

MESSRS. CROMPTON & CO., LTD.—The works will be closed from Friday night, July 31st, until Monday, August 10th. The general offices will be closed for the Bank Holiday, August 3rd, only.

MESSRS. WILLANS & ROBINSON, LTD.—The works will be closed from Friday, July 31st, to Monday, August 10th. The general offices will be closed for the Bank Holiday, August 3rd, only. The staff in attendance in the offices will deal with current contract correspondence and the supply of replace parts, &c.

For Sale.—The Eastbourne Electricity Department have for disposal an engine, alternator, &c. Particulars are given in our advertisement pages to-day.

Annual Outing.—The employés of MESSRS. E. P. ALLAM AND CO. held their annual outing on Saturday last. The party went by train to Gravesend, and thence by brakes to Gads' Hill. Delightful weather was experienced, and, after the luncheon, at which Mr. E. P. Allam presided, a cricket match was played and rambles made in the charming Dickens country. The arrangements were ably carried out by the stewards, Messrs. Waklen and Dalgarno.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 1. July. New York: The Society. Price $1.

"Annual Report of the Rand Water Board, for the Year Ended March 31st, 1914." Johannesburg: Chief Engineer's Office, Rand Water Board.

Liquidations and Dissolutions.—THE ELECTRO-MOTOR EQUIPMENT CO., LTD.—A meeting will be held at 21, Old Broad Street, E.C., on August 26th, to hear an account of the winding up from the liquidator, Mr. O. Steiner.

NO CELL, LTD.—A meeting will be held at the offices of Messrs. Moore, Partridge & Co., 2, Gresham Buildings, E.C., on August 31st, to hear an account of the winding up from the liquidator, Mr. A. H. Partridge.

MIDLAND IGNITION CO.—A meeting will be held at 35, Newhall Street, Birmingham, on August 26th, to hear an account of the winding up from the liquidator, Mr. C. H. McPherson.

ADAMS & FOX, electrical engineers, 178, High Street, Notting Hill Gate, and 23, Ladbroke Terrace Mews, W.—Messrs. W. J. Adams and W. H. Fox have dissolved partnership. Mr. W. H. Fox will attend to debts.

Trade Announcements.—THE BRITISH THOMSON-HOUSTON CO. have had two additional lines installed in their private telephone exchange at Mazda House, 77, Upper Thames Street, London, E.C. The telephone number has also been changed, and, instead of Bank 5561/2/3 as heretofore, all future calls must be made to one or other of the following numbers: Central 10434, 10435, 10436, 10437, 10438.

MR. F. BICKFORD, late with Messrs. H. R. Williams & Co., has commenced business as an electrical engineer and contractor at Bontport Street, Barnstaple.

LIGHTING and POWER NOTES.

Atherton.—PROPOSED LOAN.—The Clerk to the D.C. and the electrical engineer have been instructed to furnish particulars to the L.G.B. in regard to an application for permission to borrow £2,100 for E.L. purposes.

The Howe Bridge Spinning Co. has decided to take a supply of electricity from the D.C. for driving its No. 2 mill.

Australia.—The Sydney Council has been recommended to borrow £500,000 for the extension of the electricity undertaking in the western and northern suburbs, and to meet the overdraft.—*Australian Mining Standard.*

The Brunswick (Vic.) Council has decided to borrow £10,000 to extend its E.L. system. A further £10,000 will be required to complete the scheme.

Barnes (Surrey).—MAINS EXTENSION.—The U.D.C. has sanctioned the extension of the E.L. mains to the Priory Lodge Estate, and in Sheen Common Drive.

Blackburn.—Referring to our note last week, Mr. P. P. Wheelwright, engineer and manager of the electricity department, writes to point out that the statement that a scheme in connection with the department has been held up, owing to the consideration of reorganisation of the gas works, and that both matters are being referred to the full Council, is quite incorrect as far as his department is concerned, and the only question that has been referred to the General Purposes Committee is the report of Sir Corbet Woodall, on the reorganisation and reconstruction of the gas works. The special report mentioned in our paragraph was one that Mr. Wheelwright made in connection with a new generating station, which was accepted by the Council some months ago, and will in the near future be put in hand.

Bolton.—ANNUAL ACCOUNTS.—The accounts of the Corporation electricity department for the year ended March 31st, 1914, have just been issued, and show that the revenue from the sale of energy amounted to £69,737, against £65,514 in the previous year, and the total income, less discounts, &c., was £78,333, against £74,296. Interest, depreciation and other expenses amounted to £28,224. There was a surplus of £2,365, of which £2,000 was allocated to the relief of the rates. The capital expenditure during the year amounted to £52,619. The units sold numbered 13,727,819, against 12,605,940. This total includes power, 7,445,580; tramways, 4,396,543; and private lighting, 1,885,696. Works costs per unit were 0·537d., against 0·538d., and the inclusive cost per unit was 1·144d., against 1·202d. The average price obtained for energy was 1·13d. per unit, against 1·15d. It is anticipated that when the new power station is running the generating costs will be considerably reduced. The renewals fund now stands at £33,534.

Bradford.—The Electricity Committee has authorised the Chairman, Deputy-Chairman and the Electrical Engineer to purchase about 50 tons of copper for cable making.

Brighton.—MUNICIPAL WIRING.—The L.G.B. has forwarded to the B. of G. a copy of a letter received from the Electrical Contractors' Association (Inc.), relative to the installation of E.L. by the Guardians at the Poor Law Institution. The House Committee recommended that the L.G.B. should be given details of the work done, and pointed out that, when the work had been done by the staff, the materials had been purchased locally, and that as the special terms upon which the T.C. supplied electricity enabled the Guardians to light the buildings more economically than by gas, the Committee was of opinion that by employing its own staff it had not exceeded its powers.

Bristol.—ANNUAL REPORT.—In his report on the working of the Corporation electricity department for the year ended March 25th, 1914, Mr. Faraday Proctor, the general manager, states that the gross receipts amounted to £105,940, and the gross expenditure to £48,105. After paying capital charges there was a net profit of £8,516, and a disposable surplus of £10,927. After meeting sundry expenses and transferring £6,000 to the reserve fund, £2,314 has been carried forward. The units sold totalled 15,488,638, against 13,067,231 in the previous year. During the year the charge for street lighting was reduced by £2,000, and 608 incandescent street lamps, out of 1,158 to be installed, were equipped free of charge. The load factor was 21·16 per cent., against 20·71 per cent. in the previous year. The works costs per unit amounted to 0·518d., against 0·512d., and the total costs per unit were 1·45d., against 1·6d. The average revenue per unit from the sale of current amounted to 1·534d., against 1·683d.

PROPOSED LOAN.—The Electricity Committee has recommended the T.C. to apply to the L.G.B. for sanction to a loan of £42,000, for expenditure on mains, sub-stations, and services during the next three years.

Buckie.—E.L. SCHEME.—A large scheme of E.L. and power, derived from the river Spey, for the adjacent district, was referred to at a meeting of the T.C. The Lighting Committee had recommended that a report on the E.L. of Buckie be got from an engineer, but it was agreed to delay the matter for a year or two, in order to see if the larger scheme was taken up.

Burton.—A GAS LOAN.—At a recent L.G.B. inquiry as to an application to borrow £25,000 for the gas undertaking, the inspector pointed out the growing competition of electricity, and said he did not see his way to recommend the granting of more than £7,000 for immediate requirements.

Bury.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £40,720 for extensions at the Chamber Hall power station.

The Electricity Committee has given permission to the Lancashire E.P. Co. to supply electricity to the Robinson Kay Home.

Carlisle.—ANNUAL REPORT.—The accounts of the Corporation electricity department for the year ended March 31st, 1914, show that the total revenue was £21,229, against £19,067 in the previous year, and the generating and distribution cost was £14,068, against £10,330. There was a net deficit on the year of £209, against a profit of £1,510 in the previous year. The units sold numbered 3,140,457, against 2,531,545. The works costs per unit amounted to 0·5d., as against 0·42d., and the total costs per unit were 1·64d., as against 1·66d. The average revenue per unit was 1·62d., against 1.8d. The load factor was 18·45 per cent., against 18·87 per cent. During the year £6,181 was expended on plant, £4,953 on mains, services, &c., and £2,212 on buildings. Coal increased in cost by £1,426. In his report, Mr. F. W. Purse, the electrical engineer, states that during the past year there was an unprecedented combination of circumstances which can hardly occur again, and although there was a slight deficiency, the output and revenue were the largest on record. A three-phase H.T. system was introduced during the year.

Chobham.—PROPOSED E.L.—The Chertsey R.D.C. has received a letter from the Woking E.L. Co. stating that the company had been petitioned by residents at Chobham and Mimbridge for a supply of electricity, and that as the district lay within the area of the Ascot Gas and Electricity Co., whose mains were a long distance from Chobham, it intended applying to the B. of T. for consent to supply. The Council was asked to agree to this course, but decided to submit the matter to the Chobham P.C.

Continental Notes.—SWEDEN.—As previously reported in this journal, a Danish company has entered into an agreement with a Swedish company for the purchase of electrical energy, which will be transmitted by submarine cables across the Sound from Sweden to Denmark. The first step towards the realisation of this scheme has now been made, the work of laying the first cable having been commenced. The energy will be supplied from the Lagan power station in the neighbourhood of Helsingborg, which already has 25,000 H.P. at disposal, and will be doubled in size. At Helsingborg, where the current leaves its native country, the pressure will be reduced to 25,000 volts, and after having passed through the cable to Elsinore, a distance of 5,400 metres, the voltage will be increased to 50,000. From this point the

energy will be distributed in the usual way to various places in Zealand, as far as the town of Roskilde, to the south of Copenhagen. To the power cable itself will be attached another cable, which will serve as a protection for it against ships' anchors. In the first instance only one cable will be laid, as the whole scheme may be considered to be in the experimental stage. But if this first experiment succeeds, it is the intention to lay two additional cables. The scheme will be completed towards the autumn.

NORWAY.—The municipal authorities of Norvik, in the north, have acquired a water-course, from which an additional supply of energy to the town will be derived. There are two lakes to be dammed, which will serve as reservoirs.

It is reported from Mandal, in the south of Norway, that preparations are being made to erect a large factory at Lyngdal for the manufacture of nitrates. At the same time a large power station will be built on the River Kvina. The power available amounts to 100,000 H.P. at least, which will be transmitted to the factory. Lyngdal is situated close to the sea, and there is an excellent port, which will facilitate the shipping of the goods. The enterprise is controlled by a large company at Christiania.

RUSSIA.—The Municipality of Piotigorsk has been authorised to raise a loan of £105,000 for, among other things, an electric power station.

GERMANY.—Twenty-seven Kreise of Silesia, with the co-operation of the Provincial Council, have formed an "Upper Silesia Communal Power-Station" company, to build a power-station and distributing network for the supply of electricity in the district. The capital is 733,000 marks.

Cuddington (Surrey).—PROPOSED E.L.—The South Metropolitan E.L. Co. has informed the P.C. that it is prepared to go into the matter of a supply of electricity for the parish, and if the Council consents, will apply to the B. of T. for its permission. A Committee has been appointed to discuss the matter with the general manager of the company.

Dalkeith.—STREET LIGHTING.—As its agreement with the Electric Supply Corporation shortly expires, the T.C. is experimenting with the latest types of illuminants, with a view of improving the street lighting in Dalkeith and Eskbank.

Doncaster.—YEAR'S WORKING.—The income from the Corporation electricity undertaking for the year ended March 31st last was £14,344, and the expenditure £13,329, leaving a surplus of £1,015, against £1,114 in the previous year.

Farnworth.—L.G.B. INQUIRY.—Mr. H. R. Hooper held an inquiry on July 17th into the application of the U.D.C. for sanction to loans of £1,900 for plant, and £1,500 for prospective expenditure, in connection with the electricity works.

Grimsby.—NEW PLANT.—The Lighting Committee has approved of the expenditure of £4,975 on the extension of the electricity undertaking, as follows:—Buildings, £1,700; battery, £2,400; booster and switchgear, £800; cables, £75.

Halifax.—ANNUAL ACCOUNTS.—The accounts of the Corporation electricity department for the year ended March 31st last state that 9,670,008 units were sold, against 7,488,255 in the previous year. The total income was £55,654, against £48,025, and the working expenditure was £28,706, against £25,107. After paying interest, sinking fund and other charges, there was a surplus of £4,109, against £2,408, of which £3,893, against £3,545, was placed to the relief of the rates.

Hawkhurst.—E.L. SCHEME REJECTED.—A poll on the E.L. scheme submitted by a London firm has resulted in 102 votes in favour and 119 against. Only 221 voters polled out of 700.

Iceland.—It is reported that Mr. Pull J. Torfason, one of the most prominent business men on the island, has succeeded in obtaining a concession for the utilisation and harnessing of some waterfalls. The electrical energy derived from these will be employed for the manufacture of salt, of which large quantities are consumed every year in Iceland, and for which there is a great demand. The present price is about 37s. per ton, but it is proposed to extract the salt from sea-water by means of a special process which can be worked at a moderate cost, leaving a good margin of profit on the basis of the selling price quoted above. The scheme will require a considerable amount of capital, which the promoter is trying to get in Iceland and Denmark, although he has several offers from Germany, where the new enterprise has aroused much interest.

Ilfracombe.—DUST DESTRUCTOR.—The U.D.C. has decided to erect a dust destructor, to cost between £1,000 and £2,000, at Bowdon Farm.

Ilkley.—LOAN SANCTION.—The L.G.B. has informed the U.D.C. that it is willing to sanction the loan of £18,000 for E.L. purposes directly the B. of T. approves of the site for the generating station. The B. of T. has now consented to a site.

India.—According to *Indian Engineering*, the Amritsar municipality has applied to the local Government for a loan of Rs.4,50,000, for the purposes of the city electrification.

Knowle.—According to the *Daily Graphic*, a wooden post, erected to carry electric lighting wires in this Devon village, has taken root, and is making a vigorous growth of greenery!

Leeds.—NEW PLANT.—The Tramways and Electricity Committee has decided to recommend the Council to approve a tender for a 13,000-KW. turbo-alternator and condensing plant, at £34,160, subject to the L.G.B. granting sanction to the borrowing of that amount.

Llandyssul.—PROPOSED E.L.—Efforts are being made to provide a supply of electricity for the town, and it is understood that the project meets with much favour.

London.—L.C.C.—The Finance Committee has recommended the L.C.C. to sanction the following loans for electricity purposes:—Battersea B.C., £3,275, for plant; St. Pancras B.C., £22,530, for boilers; Stepney B.C., £3,000, for services. The Stepney B.C. has applied for £35,000, being part of a loan of £70,000, for plant, sanctioned in December, 1912, and the Committee recommends that this also be granted.

HAMMERSMITH.—YEAR'S WORKING.—A gross profit of £28,629 was made on the B.C.'s electricity undertaking for 1913-14, and the net profit was £6,386; of this sum £3,380 has been allocated to the relief of the rates, and the Finance Committee recommends that £3,000 should be carried to the reserve fund.

Loughton.—PROV. ORDER.—The County of London E.S. Co. has notified the U.D.C. of its intention to apply for a prov. order for electric supply in the Council's area.

Ormskirk.—PROV. ORDER.—The Ormskirk E.S. Co. has notified the W. Lancashire R.D.C. of its intention to apply for an order to supply electricity within the Council's area.

Newcastle (Co. Down).—E.L. INAUGURATED.—Last week the new E.L. installation was switched on by Countess Annesley.

Redditch.—EXTENSION SCHEME.—The U.D.C. has appointed Messrs. Handcock & Dykes as consulting engineers, and Mr. Mayne, the works manager, as resident engineer, to the scheme for the re-organisation of the electricity undertaking.

South Africa.—According to the *Financial News* the Portuguese Government is contracting with an English firm to supply electric power to Lourenco Marques, for three years.

Southampton.—EXPERTS' REPORT.—In a report which they have prepared on the Corporation electricity undertaking, Sir John Snell and Mr. Ernest Edmonds state that the plant and mains were generally of good type and were maintained in good condition, and that the undertaking was perfectly solvent, there being an excess of assets over liabilities of £14,000. The report states that, if desired, the charges to the Tramways Committee could be reduced. There was no necessity to reduce the rates for private lighting from 3½d. to 3d. per unit, especially as further economies in the current consumption of metallic-filament lamps were quite probable. The heating and cooking rate of ½d. per unit, if taken alone, could not be justified, but when its effect on other departments was considered, the general increase in the profits justified the policy, and even if, instead of the limited number in 1912-13, every consumer took a supply for heating and cooking at ½d. per unit, the profit of the undertaking would increase. Notwithstanding the satisfactory results of the charges now in force, the report recommends the adoption of a rateable value, or KW. charge, for domestic supply.

Southend-on-Sea.—PIER LIGHTING.—Owing to the saving made by utilising electricity in place of gas, the T.C. has decided to continue to substitute electricity for gas on the pier premises in cases where it is considered that the change will be in the interests of the pier undertaking.

Taunton.—ANNUAL ACCOUNTS.—The accounts of the Corporation electricity undertaking for the past year, show a gross profit of £5,814, of which £1,455 has been devoted to interest, £3,032 to redemption of loans, £304 to renewals account, £139 to the purchase of meters, and £173 has been carried to net revenue account.

Tunbridge Wells.—EXTENSION OF AREA.—The T.C. is to apply to the B. of T. for permission to supply electricity at Langton and Pembury, outside the Council's area of supply.

Walthamstow.—LOAN SANCTION.—The U.D.C. has received sanction to borrow the following sums for electricity purposes:—£7,247, including boiler house plant £6,726, and transformers and switchgear £521; £1,534 for H.T. cable; £1,159 for mains; and £1,162 for services.

Wombwell.—E.L. SCHEME.—The Yorkshire E.P. Co. is putting into operation its powers for supplying electricity at Wombwell, and is connecting the town to its mains.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—YEAR'S WORKING.—The report of the Corporation tramways department for the year ended March 31st, 1914, shows that the total revenue was £85,266, against £80,166, and the working expenditure was £47,036, against £43,206. Capital charges, renewals and depreciation, amounted to £24,169, against £24,435; and the net profit was £14,062, against £12,525.

The energy consumption worked out at 1·184 units per car-mile, a decrease of 0·29 unit. The reserve fund now stands at £29,508, the renewals fund at £140,480, and the sinking fund at £46,802.

The T.C. has decided to extend the P.A.Y.E. system, and 16 cars are to be altered, and six new cars constructed, on this principle. Thirty-four of these cars will shortly be in operation.

Continental Notes.—RUSSIA.—During the recent strikes, the tramway services in St. Petersburg, Moscow and Tiflis, were affected, and according to the daily Press, 150 tramcars were smashed in St. Petersburg by the strikers.

GERMANY.—ELECTRIC WATERING CARTS.—The asphalted streets of the City of Berlin itself are cleaned and watered by 60 electrically-propelled watering carts, each with rotary squeegees. The other roads are watered by 265 horse-drawn carts, but trials are being made with electric fore-carriages, with a view to the conversion of these vehicles.

Croydon.—ELECTRIC VEHICLE.—The B.C. has obtained an electric motor-car from Edison Accumulators, Ltd., at £516, for the use of the lighting department.

Dewsbury.—LABOUR DISPUTE.—The dispute between the Yorkshire (Woollen District) Electric Tramways Co. and its employés has been settled, the men having accepted the offer of the company, which embodies an increased rate of wages.

Doncaster.—YEAR'S WORKING.—There was a surplus of £1,225 on the working of the Corporation tramways for the year ended March 31st last, against £1,290 in the previous year. The income was £23,224 and the expenditure £21,998.

Edinburgh.—ELECTRIC VEHICLES.—The engineer has been instructed to report on the advisability of providing one or two electrically-driven vehicles for the use of the E.L. department.

Leith.—YEAR'S WORKING.—The revenue of the Corporation tramways department for the past year amounted to £37,967, an increase of £2,002 on the previous year, and the expenditure to £36,001, and there was a credit balance of £1,966.

London.—The Highways Committee has recommended the L.C.C. to approve the expenditure of £88,000 in respect of two 8,000 KW. steam turbo-generators for the Greenwich generating station. The present load on the station is 32,500 KW., and energy to the extent of 4,000 KW. is purchased.

In order to expedite the construction of the Lee Green-Eltham tramways, the Committee recommends that, as the Bill authorising the construction of the extension may be passed during the summer recess of the Council, the expenditure of £57,025 on the scheme be sanctioned, and that the chairman and vice-chairman of the Committee be authorised to open any tenders that may be received for the work.

The Committee also recommends that the tramway track in Burdett Road and Grove Road, E., be reconstructed, at a cost of £63,000.

In consequence of the increasing car services, the Committee recommends that the sub-stations and sub-station plant be rearranged, at a cost not exceeding £23,850.

In connection with the construction of tramways in High Street and East Hill, Wandsworth, and from London Road to Park Road, Forest Hill, the Committee recommends that the expenditure of £18,500, for cables, &c., be sanctioned.

The Committee recommends that the Council approve the agreement arrived at on June 24th by the Traffic Conciliation Board with regard to the conditions of labour of the tramwaymen, and also the supplementary estimate of £15,000, involved by the same.

The Committee also states that the question of issuing season tickets on the tramways has been considered several times, but it has come to the conclusion that the experiment should not be tried.

The Works Committee of the Westminster City Council reports that it considers the scheme of the L.C.C. Highways Committee, for the linking-up of the tramways from Victoria to Westminster Bridge, to be extremely undesirable, apart from the fact that the streets on the suggested route would not be wide enough to allow of the construction of tramways. The Committee considers that no good purpose would be served by the suggested conference, or by the City Council deferring the expression of its opposition to the scheme.

Two tramcars collided at the south side of Blackfriars Bridge on Saturday afternoon last, resulting in considerable damage to the cars and injury to two men.

The City and South London Railway Co. proposes to improve the access to Clapham Common Station, and to provide a moving stairway to the platforms.

Owing to the employment of boy conductors on the L.C.C. tramways there is a possibility that the men may strike. The men's Union has taken the matter up. The Executive Council of the Union waited upon the L.C.C. on Tuesday. It is understood the deputation urged the Council to withdraw the boys, and stated that unless this was done the men would probably cease work.

Newcastle-on-Tyne.—The threatened strike of the employés of the Corporation tramways system has been settled, and although the offers of the Tramways Committee did not meet the men's demands, they have been accepted. Increases in pay, estimated to cost £2,955, have been granted.

South Africa.—The Boksburg railless traction system apparently is not turning out to be a financial success. Councillor Malman at a recent meeting declared that the town was going to lose £5,000 a year over it. The total cost was about £10,532 per annum, whilst the revenue would not reach £6,000.

TELEGRAPH and TELEPHONE NOTES.

China.—The Chinese Government has decided to establish telephonic communication between Shanghai and Nanking.

A new wireless station, constructed for the Chinese Government by Messrs. Siemens, at Woosung, has just been completed; it forms one of a chain of six Telefunken stations.

Denmark.—The telephone cable between the three largest of the Faroe Islands has for some years been nearly useless, and the authorities have submitted a petition to the Danish Government for the establishment of a wireless service between the islands instead. It is possible that this will lead to the establishment of a wireless service between the Faroe Islands and Iceland also.

London Ambulance Service.—In the report of a Special Committee to the L.C.C. on Tuesday, it was stated that instead of providing call posts, the Committee wished to find 3,500 telephone subscribers who would allow their telephones to be used by policemen in uniform for calling the ambulances, a metal tablet being fixed on the front of the premises to indicate the fact. Those who are willing to assist in this way are requested to send their names and addresses to the Clerk of the Council.

Long-Distance Wireless Telegraphy.—During the voyage of Prince Henry of Prussia to South America last spring, news was sent twice daily from the wireless station at Nauen to the steamship *Cap Trafalgar*, the tuned-spark system and the Arco high-frequency machine being used alternately, in each instance with an expenditure of 100 KW. in the aerial. The opportunity was taken to investigate the best wave length to employ. In view of the decreased absorption by night and the less loss experienced by long waves, longer wave lengths were employed by day than by night (when advantage was taken of the high efficiency with which shorter wave lengths could be radiated from Nauen). By night 4,500-m. waves were sent from the tuned quenched-spark apparatus, and at 5 p.m. (in March) 4,500-m. tuned-spark waves, and 9,400-m. waves from the Arco high-frequency machine, were used alternately. The same receiving apparatus was used for both damped and undamped radiations. Probably the longer wave would be more suitable for use at noon on a summer's day, but, under the circumstances actually existing during these tests, the shorter wave proved the better, and quite capable of transmitting messages over 5,000 km. (3,100 miles) by day. The *Cap Trafalgar* being then S.S.W. of the Canary Isles, waves received travelled in this direction across Germany, France and Spain. This distance of transmission exceeds those attained during the *Salem* trials (when, moreover, mere measuring signals, and not news, were transmitted). Transmission by day from land to ship had not previously been accomplished over so great a distance. On resuming the service during the return voyage of the *Cap Trafalgar*, the large Nauen tower having been meanwhile completed, 4,500-m. wave signals were heard at 9,000 km. (5,600 miles) by night (across Germany, Switzerland, France, the Spanish coast on the Mediterranean, and the N.W. of Africa), while at 7,000 km. (4,400 miles), the land route being even longer than before, the whole text could be picked up save for occasional interruptions by coastal and ship stations. These night distances also constituted a record for land to ship communication.

Sterilisation of Water.—It is reported that a new method of sterilising water has been devised by Prof. J. de Kowalski, who has found a way of producing very intense ultra-violet rays more economically than with quartz mercury-vapour lamps. The rays are derived from high-frequency sparks between electrodes of invar.

The Postal Service.—The Postmaster-General has appointed Sir George S. Gibb, Sir A. F. King, Mr. G. H. Stuart, Mr. R. F. Wilkins, and Mr. H. R. Young to be a committee to examine, from the point of view of the Department and its employés, the issues with regard to the wages and conditions of employment of Post Office servants, raised by the report of the Holt Committee. Sir George Gibb will be chairman.

Sweden.—The question of laying a telephone cable between Sweden and Germany has been under discussion for a considerable time, and the plan has now been approved by the authorities on both sides. The total expenditure in connection with the project is estimated at £36,000, of which sum each State, according to the agreement, will pay half.

Wireless on Board Ship.—The Merchant Shipping (Convention) Bill was again considered in a Committee of the House of Commons, on Thursday last week. Strong objections were raised to the draft agreement between the Board of Trade and the Marconi Co., in view of the recent expiration of the 7,777 patent, and it was contended that the agreement, so far from benefiting shipowners, would tend towards the creation of a

monopoly. It was stated that seven independent companies in this country were supplying apparatus suitable for use on board ship. In the end Mr. John Burns agreed to drop the negotiations with the Marconi Co., and accepted a suggestion that the installation of wireless telegraphy on board ship should not be compulsory until six months after the Board of Trade had published rules under the Act. The Bill was reported to the House.

In reply to questions in the House of Commons regarding the draft agreement between the Board of Trade and the Marconi Co., Mr. Burns stated that the shipowners, being apprehensive about monopoly terms, requested the Board of Trade to open up communication with the Marconi Co. in the interests of the shipowners, but the latter were now satisfied that they did not require any protection that the agreement was supposed to give them.

Wireless Telegraphy and the Solar Eclipse.—The Committee for Radiotelegraphic Investigation of the British Association informs us that on the occasion of the total solar eclipse on August 21st next, five high-power wireless telegraph stations in Europe will each make a series of special emissions to provide facilities for the observation of strays, and for the measurement of the strength of signals. The Committee has sent us copies of the programme and of each Form, A, B and C, which it is issuing for use during the eclipse. Experimenters in wireless telegraphy possessing such apparatus of precision as will enable them to make accurate measurements should communicate with Mr. W. Duddell, F.R.S., 56, Victoria Street, London, S.W., and prospective observers willing to make aural estimates of signal strength or to make observations on strays (either by the graphic record method, or by the method of registering the number heard during every 30 seconds) should send an intimation to that effect, with a notification of which portion of the observations they could undertake, to the honorary secretary, B.A. Radiotelegraphic Committee, 88, Gower Street, London, W.C. They should also give the names of those of the five sending stations with which they could work.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—August 4th. U.D.C. One natural-draught chimney-type cooling tower. See "Official Notices" July 10th.

Australia.—SYDNEY.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

September 14th. Municipal Council. 22,500 yd. of 33,000-volt, three core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

RICHMOND.—Nov. 30th. Refuse destructor and auxiliary plant. Specification, &c., from Mr. C. C. Blazey, Town Clerk, Richmond, Victoria.

BRISBANE.—September 2nd. Measuring instruments, protectors and parts, telephone and telegraph instruments, for the Postmaster-General. See "Official Notices" to-day.

ADELAIDE.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., bells and cells, for the Postmaster-General. See "Official Notices" to-day.

Adelaide Tramways Trust.—September 1st. One booster set, with cables and spares.—*Australian Mining Standard.*

MELBOURNE.—August 18th. Electricity recording meters and carbon brushes, for the Melbourne City Council. See "Official Notices" to-day.

Victorian Railways Department.—October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

Austria.—August 13th. Machine tools for Prague railway workshops, including 10-ton electric lifting screws, two electric hand-boring machines, one electric quick-boring table machine, one electric motor, &c. Particulars, enclosing postage from the K.k. Staatsbahndirektion, Prague.

Belfast.—August 24th. Corporation. One electric motor tower-wagon. See "Official Notices" to-day.

Birkenhead.—August 10th. Corporation. Cooling tower. See "Official Notices" July 24th.

Blackburn.—August 1st. Twelve months' supply of steam coal for the Electricity Department. Mr. P. P. Wheelwright, Engineer and Manager.

Bradford.—Corporation. Electric installation at the Technical College Hall. Particulars from the Technical Education Sub-Committee.

Bulgaria.—August 13th. Electrical installation in the harbour of Burgas; estimated cost 248,000 fr. Guarantee, 5 per cent. Particulars of the Finance Commission, Sofia.

China.—TIENTSIN.—August 4th. Boilers, turbines, electrical power plant and coining machines, for the Government Mint. Specifications, &c. (two at 5s. each), from Sir Douglas Fox and Partners, 56, Moorgate Street, E.C.

Croydon.—The B.C. has decided to obtain tenders for a motor tower-wagon, for the Tramways Department.

Eastbourne.—August 18th. Corporation. Main machine and feeder switchboard for the electricity works. See "Official Notices" July 24th.

Electric light installation at the parish church. Sir Aston Webb, architect, London.

Halifax.—July 31st. 12 months' supply of coal for the Electricity Committee. Mr. W. M. Rogerson, Borough Electrical Engineer, Foundry Street.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" July 24th.

London.—L.C.C. The Fire Brigades Committee recommends that tenders be invited for the supply of two petrol electric chassis and mounting Magirus ladders thereon.

The Highways Committee recommends that tenders be invited for laying of cable ducts, fixing of feeder pillars, reconstruction of various motor generators, and supply of trolley wire, in connection with the Council's tramways.

August 12th. Office of Works. Supply of electric clocks on a rental basis in the London districts, for the Commissioners of His Majesty's Works. Particulars from the Controller of Supplies, H.M. Office of Works, 18, Queen Anne's Gate, S.W.

Matlock.—August 8th. U.D.C. For the supply of 1967 yards of patent steel wire tramway cable. Specifications, &c., from C. P. Foster, Esq., Tramway Manager, Town Hall.

Newport (Mon.).—August 17th. Corporation. Converting plant, &c. See "Official Notices" to-day.

Nuneaton.—August 11th. Corporation. Underground cables. See "Official Notices" to-day.

Oldham.—August 16th. Corporation. D.C. motor-generator and extension to E.H.T. switchboard. See "Official Notices" July 24th.

August 24th. Corporation. Three economisers and three induced-draught fans and motors. See "Official Notices" to-day.

Rochdale.—August 5th. Paper-insulated cables for 12 months. Particulars (£2 2s. returnable) from Mr. C. C. Atchison, Engineer and Manager, Dane Street.

Southampton.—August 6th. Installation of lighting plant, cables, &c., at the Farm Institute, Sparsholt. See "Official Notices" July 17th.

Sunderland.—August 18th. Corporation. Two 1,500-KW. machines. See "Official Notices" to-day.

Swinton and Pendlebury.—August 19th. U.D.C. Cables, fittings, &c. See "Official Notices" to-day.

Tonbridge.—August 4th. U.D.C. Steam coal for the year, for the Urban Council's electricity works. Mr. M. P. Plunkett, Electricity Works.

Walsall.—August 11th. Corporation. Coal conveyer and measuring apparatus, jib coaling crane, ash-handling plant, travelling crane. See "Official Notices" July 17th.

West Hartlepool.—August 17th. Corporation. Machine tools for tramways depôt workshops. See "Official Notices" to-day.

CLOSED.

Australia.—The following tenders have been accepted:

P.M.G.'s Department, Victoria:—
20,000 pattern A porcelain insulators, £500.—Warburton, Franki (Melbourne), Ltd.
289 cable boxes, £433; 843 ditto, £1,897; 198 ditto, £1,089.—Western Electric Co. (Australia), Ltd
100 miles rubber-insulated, tinned copper wire, £282.—B.I. and Helsby Cables, Ltd.

P.M.G.'s Department, New South Wales:—
3,500 galvanised stay rods, £512.—Siemens Bros. Dynamo Works, Ltd.
17,500 galvanised tunnel brackets, £310.—Barratt & Co.

South Australia Tender Board:—
50 tons g.i. telegraph wire, £11 7s per ton.—Geo. Wills & Co., Ltd.

Sydney Municipal Council:—
Testing transformers, £1,603; 33,000-volt switchgear, £6,293.—Australian General Electric Co.
33,000-volt transformers, £5,653.—Siemens Bros.

Home Affairs Department, Geelong:—
Green type economiser, for Woollen Mills generating station, £1,069.—Fraser, Ramsey Pty., Ltd.

—*Australian Mining Standard.*

Barrow.—The T.C. has approved of the Electricity Committee purchasing a balancer from the Phœnix Dynamo Co., at £99; switch gear from the British Thomson-Houston Co., at £1,400; and a mechanical stoker from the Underfeed Stoker Co., at £192.

Bexhill-on-Sea.—The T.C. has accepted the tender of Messrs. Siemens Bros. & Co. for a booster, at £265; and that of Messrs. Myers, Rose & Co., for 1,000 tons of Shipley or Tibshelf peas for the electricity works.

Bradford.—The tender of Messrs. Wheeler Condenser and Engineering Co. has been accepted by the Technical Education Sub-Committee for a surface condenser, at £79, and that of Messrs. Balliss & Morcom, Ltd., for a high-speed engine to specification, for £367 13s. net.

The Electricity Committee has accepted the following tenders:
Cox-Walkers, Ltd.—One voltage regulator.
S. Parsons & Co.—Steel building for housing induced draught plant.
Sturtevant Engineering Co., Ltd.—One wet air filter for 5,000-KW. turbo-alternator.
Ferguson, Pailin & Co.—Three switchgear cubicles for transformer chambers.

The Corporation Tramways Committee has accepted the tender of the British Insulated & Helsby Cables, Ltd., for 25 miles of 0000 grooved copper trolley wire, at 8½d. per lb., and of Messrs. F. C. Booth & Co. for 800 conductors' ticket boxes, at 3s. 9d. each.

Cape Town.—The tender of Messrs. Koch & Dixie has been accepted for the wiring for lights and motors for Messrs. Hermann & Canard's new tobacco factory, also for the supply and erection of a main switchboard and distribution board for the same factory.

Coventry.—The Tramways Committee has recommended the acceptance of the tender of the Daimler Motor Co., Ltd., amounting to £1,626, for two motor-omnibuses.

Croydon.—The Education Committee has accepted the tender of Mr. E. C. Price, of Croydon, for an electric light installation at Princess Road Schools, at £78.

The Lighting Committee has accepted the tender of Messrs. Wm. Cory & Sons, Ltd., for "Muirfield peas" at 16s. 3d. per ton, and "Hill House washed peas" at 15s. 11d. per ton.

Dublin.—The Electricity Committee recommends the acceptance of the tender of the General Electric Co., for the supply of Aron type meters in such numbers and sizes as required during the next two years.

Keighley.—The T.C. has accepted tenders for the supply of a 750-KW. rotary converter and transformer for the sum of £1,595; and for two water-tube boilers for the sum of £5,076, subject to the necessary borrowing powers being granted by the Local Government Board.

Kirkcaldy.—The T.C. has accepted the tender of the Pendreich Electrical Firm, Edinburgh, for 15,000 pairs of carbons (open type).

London.—L.C.C.—The Fire Brigade Committee reports having received the following tenders for the supply of electrically-driven chassis for the conversion of three horse-drawn turntable ladders to motor traction:—

	One chassis.	Two chassis.	Three chassis.
Heinrich Scheele	£725	£1,400	£2,025
Henry Simonis & Co.	780	1,450	2,160
Do. do. (alternative tender)	825	1,640	2,445
Do. do. do.	880	1,750	2,610
Mossay & Co., Ltd.	807	1,584	2,196
"Cedes" Electric Traction, Ltd.	840	1,640	2,400
British N.A.G. Motor Co., Ltd.	1,020	1,998	2,967

The Committee recommends the acceptance of the tender of Messrs. Mossay & Co., Ltd., for the supply of one electrically-driven chassis to carry a turntable ladder, for £807, on the condition that the company shall, if so required, within three months of the acceptance of the chassis, supply one additional chassis for £727, or two additional for £1,389, and that they be allowed to sub-let to the Hansa Lloyd Works A.G. the construction of the chassis (without battery).

The Fire Brigade Committee recommends that during the summer recess of 1914 the chairman and the vice-chairman of the Fire Brigade Committee be severally authorised to open any tenders received for the supply of two electrical chassis and the mounting of Magirus ladders thereon, and to accept the lowest satisfactory tender.

The Highways Committee has received the following tenders for the supply of rotary converters, static transformers, and overhead crane required in connection with the rearrangement of tramway sub-stations and sub-station plant:—

ROTARY CONVERTERS.

Dick, Kerr & Co., Ltd. (recommended)	£13,065
Bruce Peebles & Co., Ltd.	13,093
British Westinghouse E. and M. Co., Ltd.	14,196
The General Electric Co., Ltd.	14,261
The British Thomson-Houston Co., Ltd.	14,377
Siemens Brothers Dynamo Works, Ltd.	16,374

STATIC TRANSFORMERS.

The British Electric Transformer Co., Ltd. (recommended)	£5,695
The British Thomson-Houston Co., Ltd.	5,916
The British Westinghouse E. and M. Co., Ltd.	6,166
Do. do. (alternative tender)	6,011
Johnson & Phillips, Ltd.	6,420
Bruce Peebles & Co., Ltd.	7,005
Siemens Brothers Dynamo Works, Ltd.	8,420

ONE 20-TON OVERHEAD TRAVELLING CRANE.

Carrick & Ritchie, Ltd. (recommended)	£265
John Smith (Keighley), Ltd.	295
Alexander Jack & Co.	310

The Highways Committee recommends that the chairman and the vice-chairman of the Highways Committee be authorised during the summer recess of 1914 to open any tenders that may be received for the laying of cable ducts, fixing of feeder pillars, reconstruction of motor-generators, and supply of trolley wire required in connection with the Council's tramways, and to accept the most favourable tender.

The Highways Committee also recommends that the necessary repairs to the storage battery at the electrical meter testing station at Hungerford House be carried out, and that the tender of the Electric Power Storage Co., Ltd., of £165 12s., be accepted, subject to an allowance of £11 12s. per ton in respect of old lead.

MARYLEBONE.—The tender of the British Thomson-Houston Co., Ltd., has been accepted by the Borough Council for the supply and fixing of a voltage regulator for the new turbo-generator, for £150.

PADDINGTON.—The Guardians are recommended to accept the tender of the General Electric Co., Ltd., to thoroughly overhaul and repair the intercommunication telephones at the Guardians' offices and maintain the same for 12 months, at £20 7s. 6d. The following quotations have been received for the installation of internal telephones at the infirmary, and also for the improvement of the fire-alarm indicator system:—

Carr & Parr	£96 6 0	C. Mickleburgh	£107 0 0
General Electric Co., Ltd.	99 10 0	Smith & Son	114 0 0
		White & Co., Ltd., £155 2s. 6d.	

The tender of the General Electric Co. is recommended, at £78 10s., for installing telephones and maintaining the same for a period of 12 months. The Committee is of opinion that there is no necessity for alterations to the fire-alarms.

WOOLWICH.—The tender of the Brush Electrical Engineering Co., Ltd., has been accepted by the Borough Council for the supply of two three-phase 100-K.V.A. transformers, for £155.

HAMMERSMITH.—The B.C. Electricity Committee recommends that the tender of the Main Colliery Co., Ltd., be accepted for the supply of so much Graigola and Victoria coal, at 16s. 10d. per ton, as may be required during the year ending July, 1915.

In connection with the conversion of 70 street lamps to electric lighting, the following tenders have been received for the supply of lanterns and fittings required:—

	Complete lanterns.	Fittings only.
Electric Street Lighting Apparatus Co.	£1 12 0 each	£0 16 6 each
" " alternative	£1 9 0 "	—
Lucy & Co., Ltd.	£1 13 6 "	£0 12 9 each
Reason Mfg. Co., Ltd.	£1 19 0 "	£0 10 6 "
W. Edgar	£2 17 0 "	£1 12 6 "
General Electric Co., Ltd.	£2 17 0 "	£0 9 0 "
Veritys, Ltd.	£3 16 9 "	£0 12 3 "

The Committee recommends that the tender of Messrs. Lucy & Co., Ltd., be accepted for the supply of lanterns, and that, subject to certain modifications in regard to materials used, the tender of the G.E. Co., Ltd., be accepted for the supply of fittings.

For the supply of cable, &c., required in lighting the public footpath from Bloemfontein Road to Ducane Road, the following tenders have been received:—

British Insulated and Helsby Cables, Ltd. (recommended)	£56
Siemens Bros. & Co., Ltd.	£66
Johnson & Phillips, Ltd.	£69

For the supply of 24 fuse handles with fuses, &c., and 24 fuse handles, complete with extra lighting blades for low-tension distribution boards in sub-stations, the following tenders have been received:—

Universal Elec. Mfg. Co., Ltd. (recommended)	11s. 9d. each and 13s. 6d. each.
Spagnoletti, Ltd.	17s. 6d. " 16s. 8d. "
Turners & Manville, Ltd.	18s. 9d. " 22s. 6d. "

For the installation of two internal inspection pipes for the pump suction of the coal reception tanks, the under-mentioned tenders have been received:—

Westwood & Wrights, Ltd. (recommended)	£56
John Bellamy, Ltd.	64
Aiton & Co., Ltd.	66

Lindley.—Messrs. J. H. Taylor & Co. have secured the contract for electrical work at the new Adult Schools.

Pelton (Co. Durham).—The Parish Council has accepted the tender of Messrs. S. Stobart & Co., of Newcastle-on-Tyne, for the supply of electric light poles and fittings for Grange Villa Road.

Salford.—Messrs. Chamberlain & Hookham have received a contract for meters from the Corporation.

Southampton.—The T.C. has accepted the following tenders:—
B. I. & H. Cables, Ltd., for one mile of trolley wire at 8 7/16d. per lb.
Lankester & Co., for installation of electric light and heating at 101, High Street, £11 18s. 6d.
Walton & Clough, Ltd., for the erection of coal conveyors at the Electricity Works.

Stoke-on-Trent.—The T.C. has accepted the following tenders for coal for the electricity works for the ensuing year:—
Sneyd Colliery Co.—Cockshead slack, for Burslem works.
Shelton Iron, Steel and Coal Co.—Great Row slack, for Hanley works.
Florence Coal and Iron Co.—Washed slack, for Stoke works.
Moorfield Colliery Co.—Coal for Longton works.

Tenders for fuel for the central power-house have been deferred.

The Bastian Meter Co., Ltd., have again received an order from the Council for the supply of their 3 and 5-ampere meters to its various branches.

Tramway Contracts.—Messrs. Clough, Smith & Co., Ltd., have recently secured the following overhead equipment contracts:—Northampton Corporation Tramways, Far Cotton extension; Merthyr Tramways, Cefn extension; overhead construction of Hove experimental route, for the Cedes Electric Traction, Ltd.

Tunbridge Wells.—The Town Council has provisionally accepted the tender of Messrs. S. E. Haward & Co., Ltd., at £12 5s. 3d., for wiring the cemetery lodge.

West Bromwich.—The T.C. is recommended to accept the tender of Messrs. Babcock & Wilcox, for a boiler, brickwork, and extension to galleries at the electricity works; also the tender of the Rees Roturbo Co., Ltd., for a feed pump.

West Ham.—The following is a list of the tenders submitted for installing electric light at Rosetta Road School, Custom House, for the Education Committee of the county borough (Mr. William Jacques, A.R.I.B.A., architect):—

Bristow Brothers	£1,014	Malcolm & Allen	£682
Flower & Co.	898	John Biggs	681
West Ham Electric	839	Dickinson & Co.	656
McMillan & Co.	848	Weston & Sons, Ltd.	641
Smeeton & Page	844	Vaughan & Co.	639
Cathcart & Co.	831	Steel & Co.	635
Stegmann & Co.	798	Defries & Goldman	630
Procter & Co.	795	Lund Brothers & Co.	611
Arthur Newman, Ltd.	750	J. T. Halsey, Stratford, E. (accepted)	558
Nicholls & Son	707		

Whitstable.—The U.D.C. has accepted the tender of the Pulsometer Engineering Co. for electric motors and other plant for the pumping station, at £1,210 10s.

Yarmouth.—The T.C. has accepted the following tenders for coal for the Electricity Works:—

Myers, Rose & Co.—5,500 tons Shipley or butterfly slack.
Cory & Sons.—1,500 tons Clifton or Woolerton hard steam.
Wm. Cory & Sons.—1,500 tons Nixon's smokeless Welsh steam.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION.)

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

London Electricians' Strike.—The situation arising out of the dispute in the electrical trades of London was discussed at a meeting of representatives of the Electrical Trades Union and Electrical Contractors' Association on Thursday last week. The proceedings were private, but it was afterwards stated that no settlement was arrived at.

Fatalities.—SOUTH AFRICA.—A South African newspaper reports that on June 22nd, at an hotel at King William's Town, a native servant girl, while cleaning the third storey window, dropped her cloth, and in the attempt to regain it slipped from the verandah roof on which she was standing, and grasped a live 220-volt wire which runs close to the edge of the roof. For a time she was in a precarious position, with one foot on the roof and the other dangling in space. The current was switched off, and the girl fell to the ground, sustaining injuries from which she died shortly afterwards.

SUNDERLAND.—An inquiry was held by Coroner Burnicle, at Sunderland, on July 22nd, into the death of Peter Cornforth, who was killed electrically on July 20th, while working at the North-Eastern Marine Engineering Co.'s works at the South Dock, Sunderland. John Kirkpatrick said Cornforth was "striking" for him in the blacksmith's shop. Witness wanted to use a big hammer, which was worked by electricity, and he asked an apprentice blacksmith to start it. The apprentice was on his way to the switch when Cornforth rushed up to put the switch handle over. Witness waited for the hammer to start, and as it did not he looked to see the cause and saw Cornforth against the switchboard. Witness tried to pull Cornforth off, but the current "flung him off." There were live terminals on the switchboard, and there was no cover over them. In reply to Mr. W. B. Lauder, Inspector of Factories, witness said he did not know that the proper hammer boy had had shocks at the switch in question. He knew of one workman who had a shock, and witness had had a shock himself through his hand slipping on to a wire.

William Birbeck, an apprentice blacksmith, said he was asked to start the hammer, but before he could get to the switch the deceased reached it. Witness saw Cornforth's right hand slip off the handle and held there. Witness had had two shocks during the year and a half he had worked there. Mr. Joseph James said he was engineer in charge of the electrical plant, and had held that position for eight years. He was not present when the accident occurred, but tried to resuscitate Cornforth. The voltage was about 240. In reply to the Coroner, witness said he knew the live wires were unprotected, and knew that under the regulations they should have been protected. The switchboard was as supplied by the makers more than eight years ago. In answer to the Factory Inspector, witness said he did not know exactly when the electrical regulations came in, but he knew of them. There was a copy of the regulations posted up, and he was told to read them over and to mention to his superiors the alterations necessary to meet the regulations. Asked if he made mention of the switch in question, witness said he did not remember; he did not think so. Rule 3, which refers to the protection of switches, &c., was put in, and witness was asked if the switch complied with that rule. Witness answered in the negative. Asked whether, if the rules had been complied with, there would have been this fatality, witness again replied in the negative.

The Coroner said there was no doubt as to the cause of death, and the grave part of the matter was, apart from the unfortunate man's death, the negligence in not carrying out the regulation which provided that there should not be left uncovered or unprotected any dangerous part. In this case the live terminals were left unprotected. There was no dispute upon that point, and the engineer had admitted that if the regulations had been complied with, the accident would not have occurred.

A verdict was returned that "Death was due to an electric shock accidentally received."

CARDIFF.—George Gale, a Corporation electrician, was killed at Cardiff, on Thursday last week, while attending to fuses at a sub-station. He was leaning over an iron casement to reach the fuses, when he accidentally touched the terminal carrying a pressure of 2,500 volts, and was killed instantaneously. He had been used to this class of work for 12 years.

While repairing wires in a transformer tank, George Rich, an electrical engineer employed by the Cardiff Corporation, was killed on Wednesday, having apparently touched a live wire. Only last week another man lost his life by a similar accident in the same tank.—*Standard.*

GOVAN.—David Callander Morton (31), of Govan, was killed while working at Bull's metal and melloid works, Yoker, on Thursday last week. While engaged in painting the roof he fell, and, in his descent, caught hold of two electric power wires supplying energy to an overhead crane, and subsequently fell to the ground, fracturing his skull. A doctor gave it as his opinion that death took place before the man reached the ground.

BIRMINGHAM.—Mr. A. H. Hebbert (Deputy Coroner) held an inquest, on July 22nd, concerning the death of Albert William Cooper Harris (53), an electrician, who was killed on the 18th at the works of the Eyelet Co., Nechells, where he was employed. Mr. Ram, Electrical Inspector of Factories, and Mr. A. C. Lowe, Inspector of Factories, were present, and Mr. Baker (Shakespeare and Co.) appeared on behalf of the employers.

W. E. C. Jennings, assistant electric mains engineer to the Corporation, said that electrical apparatus was installed at the Eyelet Works in November, 1912, and the voltage was 5,000. Deceased had been warned of the danger. After the accident witness went to the works and found the main switch closed. The two transformer switches had been taken off, and the current was going to one side of the control panel. Before deceased touched that panel he should have switched off the current on the panel belonging to the Corporation. The Corporation strongly advised electricians before making any alterations to communicate with them and have the current switched off altogether. Witness had been told that deceased was unscrewing the bottom switch when the accident occurred. He should not have done that unless the current was off. Replying to a question, witness said he did not recommend india-rubber gloves for plant with high voltage.

Horace Bassett, the manager of the works, said deceased had charge of the electric plant, and witness considered he was an efficient workman. Deceased said he wanted to brush the transformers and refill them with oil, and witness gave him the panel key.

Albert Hammond said he accompanied deceased to the transformer room. After the transformers had been brushed and refilled with oil, deceased opened the panel door and unscrewed two screws from underneath the panel. He then touched the top of the panel, and immediately there was a flash and deceased was hurled backwards, knocking witness over. Before deceased opened the panel witness asked whether everything was safe, and an affirmative reply was received.

Dr. Winfield said that death was due to heart failure caused by an electric shock. He did not think that artificial respiration would have had any effect upon the deceased.

Mr. Ram said men who had come into contact with a voltage of 5,000 and upwards had been restored by the application of artificial respiration. He knew of one man who had recovered from a shock of 10,000 volts. Mr. Ram quoted medical opinion to the effect that it was possible to restore a victim if artificial respiration was resorted to at once.

The jury returned a verdict of "Accidental death," and added that they were of opinion that in future the Corporation should be communicated with before the panel was opened.—*Birmingham Daily Post.*

Life of Mercury Rectifier Bulbs.—Mercury rectifier bulbs used on constant-current arc lighting circuits are guaranteed for an average life of 500 hours, but this guarantee is being generally exceeded, and in some instances an average life as high as from eight to fifteen times the guarantee has been obtained. The report of the People's Gas and Electric Co., of Savanna, Illinois, recently issued, showed an average bulb life for the last three years of 8,398 hours.—*Journal of Electricity, Power and Gas.*

The Parsons 25,000-kw. Turbo-Alternator. — The *Electrical World* states that the 25,000-KW. Parsons turbo-alternator set, the installation of which has just been completed by the Commonwealth Edison Co., Chicago, was received in the United States late last summer shortly before the new tariff law went into effect. To gain the saving in Customs duties possible under the new tariff, the turbine was therefore held in bond for about a month until the date when the Act went into force. Upon unpacking the set at the end of this period it was found, however, that the insulation of the machine had absorbed considerable salt moisture during its sea voyage across the Atlantic, so that the armature end-turns had to be reinsulated before the turbo-generator could be made ready for use.

Fire Due to a Candle.—At St. James's Parish Church, Accrington, on July 22nd, an electric light installation was being put in, and two electricians were engaged running wire in the ceiling by the light of a candle. It is thought that during their temporary absence the candle fell over and ignited the woodwork, as an outbreak of fire occurred. Members of the choir were assembled for practice, and gave the alarm, and fortunately the fire was quickly suppressed. The incident is noteworthy as a warning; the use of candles should never be permitted under such circumstances.

Under the Round Table Again.—Just as certain odours are said to possess remarkable powers to recall to our memories scenes of by-gone days, so certain familiar words appear to influence a writer in one of our contemporaries with even more realistic effects, as we have noticed on more than one occasion. Last week, for instance, after naming with remarkable and suggestive fluency a variety of alcoholic liquors, he referred to "the annual meeting of the Electro-Harmonic Society on the 27th inst." The meeting took place on the 22nd.

Illuminated Proof Table.—For aligning the margins of proofs of book pages which are to be printed on both sides of the sheet, a Philadelphia printing house now saves much time by the use of a novel glass-topped proof table, beneath which are mounted several tungsten lamps. When the proof sheet, printed on both sides, is laid on this illuminated table the transmitted light shows at a glance where the page formes fail to register, and the time required to align proofs is 8 minutes instead of 20.—*Electrical World*.

Municipal Trading.—One of the subjects on which the American Municipal Executives and civic leaders at present in London are anxious to obtain information is municipal trading, which is not carried on to any great extent in the United States. This subject was set down for discussion at a sitting of the International Municipal Congress at the Anglo-American Exposition, Shepherd's Bush, last week.

The Mayor of Lambeth, who opened the discussion, said his borough did not go in for municipal trading. He believed that on the whole the feeling was against municipal trading, because it interfered with private enterprise.

Dr. Haddon (Professor of Political Science, Western Reserve University, Ohio) said there was a strong movement in America in the direction of municipalisation. The reason the idea had not gained ground in that country was because of the strong sentiment of individualism, and because the country was still largely rural in thought. Besides, under their present powers the cities were unable to finance municipal undertakings. Another drawback was that politics entered into the administrative side of their cities. He anticipated that within the next 10 years municipal trading would have a tremendous spurt in America.

The Mayor of Scarborough thought that it was extremely doubtful whether, from the points of view of price and quality, the municipality could improve upon the gas and electricity supplied by private companies.

Mr. Croot, of the West Ham Council, said their electric light undertaking yielded a net profit of £750 after meeting capital charges and interest. There was a loss on the tramway of £14,000, due to unfair competition by the omnibuses.

The Lord Mayor of York, speaking for himself, argued that better value was obtained at less money from a private company than from the municipality. The municipalisation of public utilities was fraught with danger at election times. He was strongly of opinion that the province of a city was to rule and govern and not to trade. It was a significant fact that, generally speaking, the rates were higher in those cities where the profits from municipal undertakings were large.

So much interest was shown by the American delegates in the subject that it was suggested it should be revived at a later meeting.—*Morning Post*.

Motor-'Buses and Roads.—The Joint Committee promised by Mr. Samuel to inquire into questions affecting the liability of motor-'buses, &c., to contribute to the upkeep of roads, is practically complete. Lord Balfour of Burleigh is chairman, and other members include Lord Derby, Lord Barnard, Lord Gorell, Lord Ashton of Hyde, Sir J. Barran and Captain Weigall. Although the reference is restricted to motor-'buses, there is a desire to extend it to other heavy motors.

Inquiry.—A correspondent asks for particulars of a successful adaptation of electricity for tolling church bells of considerable size—leaving them free to be hand-rung in the peal when desired.

Educational Notes.—CITY AND GUILDS OF LONDON INSTITUTE.—The report of the Council for 1913 has been published, and shows that the number of students attending the City and Guilds (Engineering) College in electrical engineering in 1912-13 was 75, compared with 78 in the preceding year; in 1904-5 the number was 160—the maximum recorded. In the civil and mechanical engineering course there were 285 students, as compared with 145 in 1904-5; 61 students took special courses, and there were 124 students in applied electricity from the Royal College of Science. At the Technical College, Finsbury, there were 71 day students taking the electrical engineering course, compared with 107 in 1904-5. The Department of Technology held examinations in 74 subjects, for which 21,878 candidates entered in the United Kingdom. The total expenditure of the Institute for all purposes was £29,539.

On the report of the delegacy of the City and Guilds (Engineering) College, the Council of the City and Guilds of London Institute has awarded the diploma of Associate of the Institute to the following matriculated third year students who have completed a full course of instruction in electrical engineering as prescribed by the Council:—R. Burleigh, S. Neville, A. T. Hitch, E. V. Wolff, S. L. Smith, A. H. Pullan, R. Gray, K. G. Marconi, T. C. C. de Moura, B. M. Gillett, J. G. D. de Grandpre, S. E. T. Pryce, J. H. D. Sheppard, P. M. Hailey, A. W. Adams, A. Morales, B. S. S. Rockey.

SOUTH-WESTERN POLYTECHNIC, Manresa Road, Chelsea.—The Polytechnic will re-open on September 28th for day classes, and on September 21st for evening classes. Courses are provided in electrical engineering, and students are prepared for the B.Sc. degree in Engineering of the University of London, as well as for the examinations for admission to the various Engineering Societies and the examinations of the City and Guilds of London Institute. The evening courses include, besides the Engineering Courses, also classes in Electrical Wiring and other trade subjects. In the Electrical Wiring Department an advanced course has been arranged for the preparation of candidates for the Final Wiremen's Examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' Day Course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the Institute has been able to fill with its students. The prospectus may be obtained at the Institute, or by post for 4d.

UNIVERSITY OF LEEDS (ENGINEERING DEPARTMENT).—The next session begins on October 5th. Particulars of the departments and names of lecturers in civil, mechanical and electrical engineering, coal gas, fuel and metallurgy, and mining are given in our advertisement pages to-day.

UNIVERSITY COLLEGE, NOTTINGHAM.—The next session opens on September 28th. Particulars of the Electrical Engineering Courses, &c., appear in our advertisements to-day.

NORTHAMPTON INSTITUTE.—The arrangements of the courses for next session are announced in our advertisement pages to-day.

CITY AND GUILDS TECHNICAL COLLEGE, FINSBURY.—The Executive Committee of the City and Guilds of London Institute has appointed Mr. Alfred J. Margetson, B.Sc. (Lond.), M.Sc., at present Assistant Professor at the City and Guilds (Engineering) College, Kensington, to the Professorship of Civil and Mechanical Engineering at the Technical College, Finsbury, vacated by Prof. E. G. Coker on his appointment to the Chair at University College.

UNIVERSITY OF LONDON, KING'S COLLEGE.—Special facilities are given at this College for research work in Civil, Mechanical and Electrical Engineering. Special courses of Advanced Lectures have been arranged on "Advanced Railway Engineering," "Factory Administration and Accounts," "The Commercial Aspect of Electrical Engineering," "Central Station Practice and its Relation to Legislative Enactments," &c. The courses of instruction in Civil, Mechanical and Electrical Engineering prepare students for the Diploma of King's College and the B.Sc. Engineering degree of the University of London. The entrance examination begins on Monday, September 21st, 1914. Full information may be obtained from the secretary.

A 25,000-KW. Turbo-Alternator.—The Kommunale Elektrizitätswerk Mark A.G., in Hagen, have installed a Brown-Boveri turbo-alternator, working with steam at 350° C. and 13·5 atmospheres, and delivering, at 1,000 R.P.M., a maximum output of 25,000 KW. ($\cos \phi = 0·8$) three-phase, 50-cycle current at 11,000 volts. Guaranteed steam consumptions are:—5·2 kg. per KW.-hour at normal full load, 5·43 kg. at three quarters, and 5·85 kg. at half full load. With boilers of 83 per cent. efficiency these consumptions correspond to 0·612 kg. of coal per KW.-hour, or 0·435 kg. per B.P.H.-hour, and an overall thermal efficiency of 22 per cent. The surface condenser has 5,200 tubes, its external dimensions being 7·6 m. × 3·5 m. diameter, and its total cooling surface 2,500 sq. m. Approximately 5,200 cb. metres of cooling water at 12° C. is circulated per hour, this duty and the removal of air and condensate being performed by two turbo-driven pumps, either of which is capable in emergency of maintaining full-load output with little deterioration of vacuum. The turbo-pumps exhaust to the mid-stage of the main turbine, or directly to the condenser, according to load. The condenser, having two-part water chambers, can be cleaned out without interrupting the supply. The floor space occupied by the turbo-generator is 16 × 4·2 metres; the height of the set is 3·5 m. overall. The condenser and auxiliaries pit is 16·8 × 5·5 m. × 7·5 metres deep. Including the condensing equipment, the total weight of the set is 385 tons, *i.e.*, about 42·5 lb. per KW.

Appointments Vacant.—Assistant telegraph engineer for postal and telegraph department of the East African and Uganda Protectorates, £350 per annum; assistant electrical engineer (£300+) for Public Works Department, Nigeria: improver, to act as switchboard attendant (15s. per week), for Kendal Corporation; canvassing engineer (£2 2s. per week), for Walsall Corporation. Particulars are given in our advertisement pages.

Municipal Tramways Conference.—The preliminary announcement with regard to this conference, which is to be held at Salford on September 23rd—25th next, shows that the following papers will be read and discussed:—

"Some Notes on Transit Facilities for Passenger Transportation in Large Cities." By Mr. J. M. McElroy, Manchester.

"Trailer and Coupled Cars." By Mr. A. L. C. Fell, London.

"The Utilisation of Tramways for Goods Traffic." By Mr. W. Clough, Bury, and Mr. G. W. Holford, Salford.

The Midland Hotel, Manchester, will be the headquarters, and a preliminary reception will be held there on the evening of September 22nd. Both the Salford and Manchester Tramways Committees are entertaining the visitors, and an excursion to Chatsworth is proposed for September 25th.

Institution and Lecture Notes.—VICTORIAN INSTITUTE OF ENGINEERS.—At a meeting on June 10th it was resolved that the Institute should take steps towards obtaining incorporation under the title "Australian Institution of Engineers," and should seek closer union with the Institutes in other States of the Commonwealth.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS.—We have received the programme for the excursion to the Home Office Experimental Station at Eskmeals, on Saturday, August 29th. A number of experiments on the ignition of coal-dust and fire-damp will be carried out.

INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE LOCAL SECTION).—Mr. H. W. Clothier, who has been Hon. Secretary to the Section for many years, is retiring from that office, his successor being Mr. J. R. Andrews, 6, Sanderson Road, Newcastle-on-Tyne.

ASSOCIATION OF ELECTRICAL STATION ENGINEERS.—During the last few weeks very few meetings of the Association have been held owing to the holiday season, but meetings will start again at the end of August. The annual conference of the Association has been arranged for the first week in October; at this Conference the future action of the Association will be decided upon, taking into consideration recent events.

No meeting has yet taken place between the A.E.S.E. and the Associated Municipal Electrical Engineers (Greater London) as suggested by the A.E.S.E. in a circular letter of February 9th last, owing to the impossibility of the A.M.E.E. finding a date convenient to their members, but the A.E.S.E. has been given to understand that every endeavour is being made to fix a convenient date for the meeting as early as possible.

With regard to the recent discharge of a member of the A.E.S.E. from the Corporation electricity generating station at Coventry, a meeting was arranged on Monday last between the secretary of the Association and the chief engineer and chairman of the Electricity Committee; unfortunately, the chief engineer was taken ill, and was unable to attend. The chairman stated that the act of appealing to the Committee by the man who was discharged, over the head of the chief engineer, was rank insubordination, and that the Committee must support the engineer. At a meeting of the Coventry Town Council, on Tuesday last, the matter was brought up, but the Council decided to let it drop. There is a possibility of further negotiations when the chief engineer has recovered from his illness.

G.E.C. Sports.—On Saturday, July 18th, the Witton Athletic Club held their annual sports at Witton. These sports are open to the whole of the G.E.C. organisation, and large contingents of competitors and visitors travelled from the G.E.C. branches and works in all parts of the country in order to compete. Over 50 came from Cardiff, and Osram Lamp Works contributed a strong team of picked athletes. Amongst the valuable prizes were the Hallgarth cup for the 100 yards race, the Byng cup for the best relay team, the Directors' cup for the department showing the best athletic prowess, and a magnificent trophy, the Hirst cup, for the finest G.E.C. athlete. For the purpose of the last two cups the Witton Works were divided into 10 sections, each other branch and works constituting a section. Points were allotted to the first, second and third in each event, as well as to heat winners for the purpose of deciding the winners. The competition for the cups was very keen, although two sections—Osram Lamp Works, and Section 5 of Witton Works (switchgear department, arc lamp department, export department, and publication department)—soon gained a clear lead of all the others, and Section 5 ultimately gained the victory by 46 points to 39, mainly as a result of organisation, the men running entirely for their section by giving up the prospects of more valuable prizes in one race in order to make sure of points in other races. Not only did Section 5 win the Directors' cup, but one of their number carried off the Hirst cup. The Byng cup was gained by Osram Lamp Works, and the tug-of-war by the Witton engineering department. At the conclusion of the sports, Mrs. Railing presented the prizes.

Westinghouse Strike Ended.—The striking employés of the Westinghouse Companies at East Pittsburgh, Pa., voted on July 9th to go back to work. The works are now running full time.—*Electrical Review and W. Electrician.*

Electrolytic Disinfecting Fluid.—In his report for the year 1913, Dr. F. W. Alexander, medical officer of health to the Borough of Poplar, states that 66,740 gallons of the electrolytic fluid were produced, at a cost of £71 for electricity (1½d. per unit) and £56 (or £62—there is a discrepancy.—EDS.) for material. Since the installation of the plant in 1906, when the output was 17,000 gallons, the total production has amounted to 312,999 gallons, at a cost of £613 (under ½d. per gallon). The fluid is supplied to the Public Health Department, the Sick Asylums, the Board of Guardians, the Works Department, four L.C.C. schools, and to the swimming baths.

Similar plants have been supplied to the War Office and the Admiralty, to Finland, Buenos Ayres and Rangoon; Gateshead Corporation has ordered one, and a large installation is being carried out for Portsmouth Corporation, to use ordinary sea water. A new double cell has recently been constructed, of slate, in such a form that electric leakage from one cell to another is prevented; this cell is cheap, and can be made in a few days. Current is taken directly from the Council's mains.

Fire Prevention.—The British Fire Prevention Committee concluded its summer session last week with a series of tests relating to wired glazing. Having regard to the number of applications for interesting tests with fire-resisting materials and systems of construction, the Committee has decided this year to have a vacation session, and there will thus be tests during August and September. The Russian Government proposes to make a substantial grant of £5,000 or more to the Russian Fire Society for the erection of a testing station in St. Petersburg on the London model.

Edison & Swan New Showrooms.—Yesterday morning the new City headquarters of the Edison & Swan Co., at 123-125, Queen Victoria Street, E.C., were thrown open to inspection by the Press. The premises include a spacious ground-floor showroom occupying an area of some 83 ft. × 53 ft., with a gallery on either side, a trade entrance, with counter, &c., in Upper Thames Street, and upper floors for stores. The showroom is one of the finest we have seen, and it is almost needless to add that a very complete display is being made of electric fittings of all kinds, cooking and heating apparatus, switchgear, lamps, bells, &c., and the various apparatus with which the Edison & Swan Co.'s name is associated. We hope to give further particulars at a later date.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Lancaster T.C. has increased the salary of MR. E. C. MILNES, electrical engineer, by £25, to £250.

MR. A. M. KISSACK has resigned his position as charge engineer at the central power house of the Stoke-on-Trent Corporation, and MR. A. T. GILBRIDE has been appointed in his place, at a commencing salary of £120 per annum. MR. H. V. C. COTTON, charge engineer at the Burslem Works, has been appointed charge engineer at the Longton Works, at a commencing salary of £2 per week. MR. J. BICKENTON, switchboard attendant, has been appointed charge engineer at the Burslem Works at a salary of £1 12s. 6d. per week.

MR. C. BARTON has been appointed chief shift engineer at the Bexhill Corporation electricity works, and a second shift engineer is to be engaged.

Pressure of business has led to the resignation of his commission in the Territorials by MR. H. RICHARDSON, the city electrical engineer of Dundee. Mr. Richardson has been associated with the Volunteers and Territorials for 11 years.

The salary of MR. W. SCOTT, acting charge engineer at the Woolwich Electricity Works, is to be increased from £2 6s. to £2 10s. per week as from October 1st next.

MR. E. G. BOISSIER, mains superintendent, having resigned, the Derby T.C. has appointed MR. G. D. ARDEN, assistant mains superintendent, as his successor, at a salary of £200 per annum.

General.—With reference to the illness of MR. BARRALET, mentioned in this column three weeks ago, that gentleman, who we are pleased to learn is now convalescent, desires to thank the large number of friends who have been so kind as to make inquiries.

The wedding of MR. R. P. YATES, of Messrs. Gillespie & Beales, with Miss D. Lidbetter, took place at Halifax on July 23rd. As a memento of the occasion a presentation was made at the offices of the firm, consisting of a handsome canteen of cutlery and table silver, on behalf of the staff of Messrs. Gillespie & Beales and the British Electric Equipment Co., Ltd.

At the works of Messrs. C. A. Vandervell & Co. a presentation was made on July 23rd to MR. S. F. H. PARSONS, chief draughtsman in the Commercial Drawing Office, on the occasion of his marriage. The present consists of a fine case of cutlery from the management and staff of the company. The presentation was made by Mr. A. G. Goodwin, general manager, on behalf of the subscribers.

DR. W. G. RHODES has resigned from the position of chief lecturer in the electrical engineering department at the Salford Technical Institute, and the Salford Education Committee has appointed MR. EDWARD H. DIXON, B.Sc., of Southampton, to fill the vacancy.

MR. G. MURRAY, of the British Thomson-Houston Co., has been appointed electrical engineer to the Afghan Government.—*Indian Textile Journal.*

The King received MR. MARCONI at Buckingham Palace on Friday last week, and conferred on him the Honorary Grand Cross of the Victorian Order.

The marriage took place, on July 24th, of MR. HENRY SKELLERN JACKSON, late of Burnley, and now of Johannesburg, Transvaal, to Miss Barbara Muir, late of Kilmarnock, and now of Frosburg, South Africa. For some years after the war, Mr. Jackson was electrical engineer at Robinson Gold Mine, and he is now with the Witwatersrand Deep G.M. Co. in a similar capacity.

MR. R. W. DAVIES, of Frodsham, who is leaving the British Insulated and Helsby Cables, Ltd., to take up new duties at Warrington, has received a present from his colleagues.

COL. JOHN E. BROADBENT, C.B., R.E., has been appointed to succeed the late Mr. Henry Collins, as a director of the Reading Electric Supply Co.

MR. G. BRANCH has joined the staff of Messrs. H. R. Williams and Co., of Barnstaple, as electrical engineer.

MR. G. R. DRUMMOND, late electrical engineer to the Bikanir Government, has been appointed State electrical and mechanical engineer to the Jodhpur Durbar.—*Indian Textile Journal.*

MR. and MRS. MARK ROBINSON celebrated their golden wedding on Monday last, the entertainment taking the form of a trip up the Thames in the steam launch *Formosa*, starting from Hampton Wick. A golden-covered cake was cut on board.

On the 22nd inst., at Longsight, Manchester, MR. H. L. AINSWORTH, head traveller of Messrs. J. & H. Grevener, was married to Miss Eva Beckett, of Manchester; he was presented by the firm with a handsome barometer, and by the staff with a salad bowl and gold-mounted cigarette-holder.

ALDERMAN DAVID SHANKS, a well-known manufacturer of electric light fittings in Birmingham and the founder of David Shanks & Co., Ltd., Aston, has been added to the local bench of magistrates.

NEW COMPANIES REGISTERED.

F. Parks, Ltd. (137,096).—This company was registered on July 21st, with a capital of £10,000 in £1 shares, to carry on the business of wholesale and retail manufacturers, importers and exporters of, and dealers in, lamps and lampshades for electric and other lamps and component parts thereof, electric and other fittings, lamp stands, &c., and to adopt an agreement with F. G. Parks. The subscribers (with one share each) are:—F. G. Parks, 21, Berners Street, W., lamp shade manufacturer; Mrs. A. S. Parks, 45, Sotheby Road, Highbury Park, N. Private company. The number of directors is not to be less than two or more than five; F. G. Parks is the first director; qualification, £100; remuneration (except managing director) as fixed by the company; solicitors, Cooper, Bake, Roche and Fettes, 6-7, Portman Street, Portman Square, W.

Morris, Warden & Co., Ltd.—This company was registered in Edinburgh on July 16th, with capital £6,000 in £1 shares. To acquire and carry on the business of Morris, Warden & Co., engineers, manufacturers of and dealers in electrical and engineering appliances. The subscribers (with one share each) are:—Willoughby C. Warden, 68, Gordon Street, Elmsford, metal merchant; Andrew B. Morris, 68, Gordon Street, Elmsford, metal merchant; Ernest George Tidd, 63, Gordon Street, Elmsford, engineer; Kenneth W. Warden, 68, Gordon Street, Elmsford, engineer. The first directors (to number not less than two or more than six) are W. C. Warden, A. B. Morris, E. G. Tidd and K. W. Warden; qualification, £100.

Aluminium Foil Co., Ltd. (137,133).—This company was registered on July 23rd, with a capital of £5,000 in £1 shares (1,200 "A" and 3,800 ordinary), to carry on the business of rollers and workers of aluminium and other metals, electricians, electrical engineers, &c. The subscribers (with one share each) are:—N. G. Paterson, 30, Mayhill Road, Charlton, S.E., accountant; J. H. Andrews, 8, Lyndhurst Road, Higham's Park, cashier. Private company. The first directors are K. M. Clark, E. C. Gates, and H. J. Jack (managing director). Remuneration (except managing director) as fixed by the company. Registered office, 52, Coleman Street, E.C.

Self-Protector, Ltd. (137,155).—This company was registered on July 23rd, with a capital of £5,000 in 3,000 first preference and 1,500 second preference shares of £1 each, and 4,000 ordinary shares of 2s. 6d. each, to acquire from A. Jönckbeere, of 9 and 10, King Street, Cheapside, E.C., the benefit of certain existing inventions relating to electromagnetic apparatus and cable connections for burglar alarms and like systems, &c. The subscribers (with one second preference share each) are:—W. Durrant, 9 10, King Street, E.C., secretary; H. W. Bird, 44, Endymion Road, Finsbury Park, N., engineer. Private company. The number of directors is not to be less than two or more than seven; the first are R. W. Wright, A. E. Brown and A. Jönckbeere. Remuneration (excepting managing director, if any), £150 each per annum. Registered office, 9-10, King Street, E.C.

Electro-Magneto Motors, Ltd. (137,168).—This company was registered on July 24th, with a capital of £10,000 in 1s. shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—F. B. Spencer, 10, Versailles Road, Anerley, S.E., clerk; J. Connor, Crosby Buildings, Crosby Square, E.C., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first, who shall be permanent; remuneration as fixed by the company. Registered office, Crosby Buildings, Crosby Square, E.C.

Health Humidifier Co. (Blackburn), Ltd. (137,173).—This company was registered on July 24th, with a capital of £3,000 in £1 shares, to take over the business of engineers and patented process manufacturers carried on at Blackburn, as "Thomas Forrest Smith," to acquire from T. F. Smith, W. Scales and F. Scales, all their respective interests in Patent No. 13,624 of 1913, granted to the said T. F. Smith, and to carry on the business of suppliers of light, heat and motive power, electrical, mechanical and general engineers, &c. The subscribers (with one share each) are:—Thos. Forrest Smith, Langho, Blackburn, engineer; Wm. Scales, Eastlee, Ramsgreave, Blackburn, funeral undertaker; Fred. Scales, 22, Audley Lane, Blackburn, funeral undertaker. Private company. The first directors are Thos. Forrest Smith, Wm. Scales and Fred. Scales; qualification, £40. Registered office, Central Works, Eagle Court, Darwen Street, Blackburn.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electro-Flex Steel Co., Ltd.—Issue on July 10th, 1914, of £3,000 debentures, part of a series of which particulars have already been filed.

Premier Electric and Hardware Co., Ltd.—Second mortgage debenture dated July 14th, 1914, to secure £637 10s., charged on the company's undertaking and property, present and future, including uncalled capital subject to first debenture. Holder: E. H. Hawkins, 4, Charterhouse Square, E.C.

Underground Electric Railways Co. of London, Ltd.—Charge of 45,000 additional shares of £10 each in the London General Omnibus Co., Ltd., dated June 29th, 1914, supplemental to indenture dated April 1st, 1912, to secure £1,400,000 6 per cent. first cumulative income debenture stock. Holders: Union of London & Smith's Bank, 2, Princes Street, E.C. Also indenture of even date (supplemental to charges dated July 30th, 1908, and April 1st, 1912, securing £6,500,000 income bonds), charged on above-mentioned property, as collateral security and subject to above-mentioned charge. Holders: London County and Westminster Bank, Ltd., 41, Lothbury, E.C.

Tilney Manufacturing and Testing Co., Ltd.—Particulars of £1,000 debs., created April 8th, 1914, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

St. Austell and District Electric Lighting and Power Co., Ltd.—Agreement dated June 30th, 1914, extending time for payment of first and second debs., each for £2,000, and increasing rate of interest upon the former, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: First Debenture-holders.

Fardon & Carpenter, Ltd.—Debenture dated July 17th, 1914, to secure £250, charged on the company's undertaking and property, present and future. Holder: R. H. Mills, 179, Maida Vale, W.

Birkdale District Electric Supply Co., Ltd. (70,259).—Capital, £50,000 in £5 shares; return dated April 28th, 1914, 9,200 shares taken up, £5 per share called up on 6,000, and £2 per share on 3,200 shares, £36,400 paid. Mortgages and charges: £3,000.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares; return dated May 28th, 1914; 6,500 shares taken up, £10 per share called up on 6,100, £61,000 paid, £4,000 considered as paid on 400 shares. Mortgages and charges: £50,000.

Trafford Power and Light Supply Co., Ltd. (72,601).—Capital, £80,920 in £1 shares (23,120 pref. and 57,800 ord.) Return dated July 14th, 1914; all shares taken up; £80,920 paid. Mortgages and charges: £60,500.

Urban Electric Supply Co., Ltd. (57,986).—Capital, £640,000 in 89,000 ord. shares of £3 each, 50,000 pref. shares of £5 each, and 150,000 shares of £1 each. Return dated April 15th, 1914; 80,000 ord. and 50,000 pref. shares taken up; £3 per share called up on the ord. and £5 per share on the pref.; £490,000 paid. Mortgages and charges: £411,951.

CITY NOTES.

City of Carlisle Electric Tramways Co., Ltd.

THE directors' report for 1913 shows that after providing for debenture and loan interest and writing off the sum of £529 from the suspense account, there is a balance at the credit of profit and loss account amounting to £33, which will be carried forward to next year's accounts. Included in the working expenses for the year is the cost of a reversible booster installed in the Carlisle Corporation's power station. The directors recommend that an issue of £20,000 6 per cent. second debentures be made by the company, the proceeds of which can be utilised to pay for the outstanding portion of the cost of the reconstruction of the system.

The ordinary general meeting was held on Wednesday, at the offices, 66, Queen Street, E.C., Mr. Wm. Shearer presiding. The proceedings were private, but we were informed that the report and the resolution authorising the issue of £20,000 6 per cent. second debentures were carried unanimously.

Electrolytic Co. (Spain and Portugal).—The annual meeting was held on Tuesday at the offices, 18, Eldon Street, Finsbury. We are unable to give a report of the proceedings as a representative of the ELECTRICAL REVIEW, who attended for that purpose, was informed that the meeting was private.

County of London Electric Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year to June 30th last at the rate of 5 per cent. per annum, less income-tax.

Vickers, Ltd.—Interim dividends for the half-year to June 30th last will be paid as follows:—2½ per cent. (less tax) on preferred 5 per cent. stock, and 5 per cent. preference shares; 1s. per share (free of tax) on ordinary shares, including the 1,110,000 recently issued, on which £1 has been paid. Dividends will be posted on August 26th.

Northampton Electric Light and Power Co., Ltd.—The directors have declared interim dividends at the rate of 5 per cent. per annum on both the ordinary and preference shares.

Chelsea Electricity Supply Co., Ltd.—An interim dividend at the rate of 4 per cent. per annum, less income-tax, has been declared on the ordinary shares for the past half-year.

Blackpool and Fleetwood Tramroad Co.—The directors have declared an interim dividend at the rate of 4 per cent. per annum.

National Gas Engine Co., Ltd.—An interim dividend at the rate of 7½ per cent. per annum has been declared.

German Electrical Companies.

THE accounts of the *Elektra A.G., of Dresden*, show gross profits of £22,900 for 1913 as compared with £22,700 in the preceding year. After setting aside £4,300 for depreciation and reserve funds as against £4,200 in 1912, the balance permits of the payment of a dividend of 6 per cent., being the same rate as in the previous year.

The *Kabelwerk Wilhelmineschof, of Berlin*, records an increased turnover in 1913, so that all branches of the company's works were fully occupied. Including the balance brought forward the accounts exhibit net profits of £13,600 as compared with £11,900 in 1912, and a dividend of 15 per cent. has been declared on share capital of £50,000, being the same rate as in the preceding year.

The *Elektro Treuhand A.G.*, which is a financial bank, jointly owned by the A.E.G. and the Siemens-Schuckert Works, reports interest receipts amounting to £16,900 for 1913 as compared with £15,600 in 1912, and £41,250 as dividend on shares held in the Hamburg Elevated railway, being the same amount as in 1912. After defraying the interest charges on loans the accounts indicate net profits of £25,100 as against £23,100 on a paid-up share capital of £375,000.

The *Hochfrequenz Maschinen A.G.*, which owns the Goldschmidt patents for high-frequency generators in Germany and which is interested in the Compagnie Universelle de Télégraphie et de Téléphonie sans Fil of Paris, now proposes to distribute the profits which had been placed to a suspense account and which arose from the patent transfer transactions concluded with the French company about two years ago. The amount in question is £46,900, which is to be divided by the payment of 24 per cent. on the £80,000 of A shares and 57.6 per cent. on the B shares of £25,000.

The report of *Hartmann & Braun A.G., of Frankfort-on-Main*, states that the turnover in 1913 experienced a considerable increase as compared with the preceding year. As gross profits the accounts indicate the sum of £100,000 as against £93,500 in 1912, and the general expenses and taxes were £50,000 as contrasted with £46,000. After setting aside £11,000 for depreciation as against £9,700 in 1912 and making other appropriations, the net profits and balance forward are returned at £27,800 as compared with £29,000. The directors recommend a dividend of 10 per cent. on ordinary share capital of £85,000, being the same rate as in each of the three preceding years.

The *Korting & Mathiesen Bogen Lampenfabrik, of Leutzsch*, reports net profits of £20,000 for 1913 as contrasted with £30,000 in the previous year, and the payment of 10 per cent. as against 20 per cent. The report attributes the less satisfactory results to the general unfavourable situation. At the recent meeting it was stated that good hopes were entertained in regard to the arc lamp business, which was expected to revive in the autumn. The position of the arc lamp in relation to the glow lamp had in part already been cleared up as, for instance, municipal authorities, the railways and large establishments had unreservedly decided in favour of the former, whilst numerous cases existed where the arc lamp had supplanted the glow lamp.

The C. Lorenz A.G. (Telephon und Telegraphenwerke), of Berlin, reports that the year 1913 was exceptionally favourable as the plant was fully employed and the turnover reached record figures, but sale prices in general were very low both in the business with government authorities and with private customers. After devoting £16,000 to depreciation as against £12,000 in 1912, the accounts show net profits of £29,000 as compared with £19,700, and a dividend of 20 per cent. has been declared on share capital of £70,000 as in the previous year, and a bonus of 5 per cent. has also been paid out of the profits arising from the company's association with the High Frequency Machine Co. Although the stock of orders brought over from 1913 was greater than a year previously, a slackening in new orders has taken place in the current year.

The directors of the *Felten & Guilleaume Carlswerk A.G., of Mulheim*, reporting on the past year, state that the volume and value of the turnover in 1913 exceeded the record figures for 1912. Satisfactory results were also yielded by the company's investments. A decline in the proceeds from the Norddeutsche Seekabelwerke owing to inadequate orders was more than counterbalanced by greater proceeds in the case of the Land und Seekabelwerke, Escher Wyss & Co., and the Treuhand Bank fur die Elektrische Industrie. The collection of the debts and the settlement of other matters in connection with the winding-up of the former Frankfort works continued their naturally slow course. The proposed construction of steel works in Luxemburg for an annual production of 200,000 tons in order to supply the requirements in semi-finished steel was definitely resolved upon in December, 1913, after the company had secured further government iron ore concessions and the undertaking had consequently been placed upon a wider basis. After further reference to the iron and steel department and the wire trade, the report mentions that the copper works, the cable factory and the factory for insulated wires were satisfactorily employed at good prices. The manufacture of high-pressure cables for over 50,000 volts was successfully advanced, and special attention was devoted to the development of telephone cables, whilst the production of special articles was undertaken in the rubber factory for technical goods and in the metal works. The systematic transformation of the works, plant and equipment was continued by the expenditure of considerable money, and the improvements introduced enabled the increased output to be effected with approximately the same officials and workmen, who numbered 6,851 as compared with 6,846 in 1912. The accounts exhibit the following figures for the two years:—

	1913.	1912.
Share capital	£2,750,000	£2,750,000
Loan capital	1,193,500	1,218,000
Gross profits	603,000	547,000
Depreciation	86,000	83,000
Net profits and balance forward	321,000	278,000
Dividend, per cent.	8	8

The *Continentale Gesellschaft fur Elektrische Unternehmungen, of Nuremburg*, reports that the unfavourable economic conditions prevailing in 1913 had but little effect upon the company's interests in lighting and tramway undertakings. The gross profits are returned at £157,000, as against £146,000 in 1912, and the net profits at £108,000 as compared with £99,000. It is intended to distribute 6 per cent. on the preference capital of £1,556,000, as compared with 5½ per cent., the ordinary shares of £44,000 again receiving no dividend. In addition to undertakings administered by the company and representing a total of £1,152,000, the securities in portfolio comprise £880,000, apart from syndicate investments for £409,000.

The *Elektrizitats A. G. vorm, Lahmeyer & Co., of Frankfort-on-Main*, which is now essentially an investment company, reports that the undertakings in which the company is interested experienced a favourable development in 1913, thus permitting of an improvement in the dividend. The gross profits amount to £184,000, as compared with £156,000 in 1912. After defraying general expenses and interest on the loans of £1,500,000, the accounts show net profits and balance forward of £100,000 as against £84,000 in the previous year. It is proposed to pay a dividend of 7 per cent. on paid-up capital of £1,312,000, as contrasted with 6 per cent. in 1912 and 5 per cent. in 1911. The company holds shares of £600,000 in the Felten & Guilleaume Co., and exchanged shares of £1,050,000 with the Zurich Bank for Electrical Enterprises three years ago. Apart from investments the company owns supply works which are valued at £84,000, the former being put at £2,387,000.

Underground Electric Railways Co.—The Underground Electric Railways Co. of London, Ltd., has now, with the sanction of the Court, become a share and securities holding company. The revenue receipts of the company in respect of the first six months of the current year remaining after paying or providing for all revenue outgoings in respect of the same period would, in the opinion of the board, justify the distribution of approximately £60,000 by way of interim dividend on the shares, according to their respective rights. The board, however, have decided to defer the question of the payment of a dividend until the next annual meeting of the company, when it can be dealt with on the audited accounts for the complete year. It is announced that interest on the 6 per cent. first cumulative income debenture stock will be paid on September 1st next, less income-tax, at the rate of 6 per cent. per annum, and coupon No. 13 off 6 per cent. income bonds of this company will be paid, free of income-tax, at the rate of 6 per cent. per annum on the same date.—*Financial Times.*

Metropolitan Railway Co.—The figures for the past half-year, including the receipts and expenditure of the Great Northern and City line, show an increase in gross receipts of £42,452, and an increase in expenses, including debenture interest and other fixed charges, of £41,700. This will admit of the payment of 1½ per cent. per annum on the ordinary stock, the same as last year, after making similar provision for depreciation, &c., and leaving a corresponding balance to that carried forward in June, 1913. The Surplus Lands Committee announces that the balance for the half-year ended June 30th, 1914, including the sum brought forward from 1913 available for payment of an interim dividend on the Surplus Lands stock, amounts approximately to £39,000. The interim dividend at the rate of 2¾ per cent. per annum absorbs about £36,000, leaving to be carried forward £3,000.—*Financial Times.*

Continental.—SWITZERLAND.—The balance-sheet of the Société Electro-Métallurgique, Procédés Paul Girod, for the last financial year, shows a net profit of only £4,708, as compared with £17,046 in 1912. Including the amount brought forward, there is an available balance of £20.926, which, in view of the unsatisfactory position, the directors recommend shall be carried forward to the current year.

NORWAY.—Under the name of the Tysse Elektrometallurgiske Aktieselskap, a new company has been formed at Kristiania for the purpose of taking over some works at Hardanger, which will be altered to suit the manufacture of ferro-alloys and similar products. The capital of the new company is £44,400 fully paid, and operations will be commenced in the near future. The buildings to be taken over are presumably those which previously belonged to the Hardanger Electrical Iron Works.

Mather & Platt, Ltd.—An interim dividend on ordinary shares of 5 per cent., free of tax, for the half-year to June 30th, being at the rate of 10 per cent. per annum, has been declared.

Paisley District Tramways Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum has been declared on the 5 per cent. cumulative preference shares for the half-year to June 30th last.

City of Buenos Aires Tramways (1904), Ltd.—For the quarter to June 30th last, the usual dividend of 1¼ per cent. has been declared, payable August 17th.

Bank Rate.—The Bank Rate was yesterday raised from 3 to 4 per cent.

Chatham and District Light Railways Co.

THE directors' report for the half-year ended June 30th, 1914, shows as follows:—Revenue, £23,548; expenses, £13,756, leaving £9,793; less rent of Rochester Corporation lines, £1,872; interest on debentures, £934; interest account, £508 = £3,314, leaving £6,479; plus £819 brought forward, making the balance £7,298. £2,940 is to be applied to dividend at the rate of 5 per cent. per annum for the half-year on the preference share capital, £1,590 to dividend at the rate of 3 per cent. per annum for the half-year on the ordinary share capital, and £2 768 is to be carried to revenue new account. The traffic receipts show an increase of £501, and the expenses an increase of £688 as compared with the receipts and expenses for the corresponding half-year of 1913. A further £2,000 debentures of the company were purchased and redeemed on 30th ult. Three additional cars have been ordered and will be put into service shortly. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
Dec. 31st, 1912 ..	14·98	4,850,273	£23,634	1·17d.	567,202	47
June 30th, 1913 ..	14·98	4,669,151	£22,718	1·17d.	540 192	47
Dec. 31st, 1913 ..	14·98	5,210,322	£25 519	1 17d.	567,634	47
June 30th, 1914 ..	14·98	4,889,135	£23,214	1·14d.	573,243	47

Lanarkshire Tramways Co.

THE directors report for the half-year ended June 30th, 1914, that there was a revenue of £50,595, and the expenses were £32,650, leaving £17,945, less contributions payable to local authorities £1,433, interest on debentures £911, interest account £857, interest account—Lanark County Council Tramways £799 = £4,000, plus £1,991 brought forward, leaving a balance of £15,935. Out of this the dividend at the rate of 6 per cent. per annum for the half-year on the issued share capital absorbs £10,290, and £5,645 is carried to revenue new account. The revenue for the half-year shows an increase of £7,145 and the expenses an increase of £7,995 as compared with the revenue and expenses for the corresponding half-year of 1913. The increase in expenses was partly due to operating the lines leased from the Lanark County Council and partly to increased wages to the staff and heavier maintenance charges for the permanent way. The Lanark County Council Tramways were completed on February 10th last and are now in full operation. The directors will, as usual, provide for depreciation in the accounts to December 31st next.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No of cars.
June 30th, 1912 ..	23·32	7,062,726	£36,570	1·24d.	893,927	64
Dec. 31st, 1912 ..	23·32	8,202,018	£41,867	1·21d.	955,164	64
*June 30th, 1913..	24·62	8,579 876	£42 884	1 20d.	979,631	66
*Dec. 31st, 1913..	34·29	9,471,832	£47,760	1 21d.	1,074 440	78
*June 30th, 1914..	†36 47	9,926,810	£49,918	1 21d.	1,169,837	78

* Includes motor-omnibus service. † Includes motor-omnibus service 8·04 miles.

Monterey Railway, Light and Power Co.—Owing to the continuance of the disturbed political conditions in Mexico, arrangements with the Government of the State of Nuevo Leon for a settlement of the claim of the Monterey Waterworks and Sewer Co. under the Government's guarantee of 10 per cent. on the capital expenditure have not yet been completed. Notwithstanding this, it would have been possible to provide the interest on the debenture stock but for the low rate of exchange prevailing, and on this account the directors regret that they are compelled to postpone the payment of the interest on the 5 per cent. first mortgage debenture stock, due on August 2nd next, until such time as it is possible to transfer the money on reasonable terms. If settled Government be restored the rate of exchange may be expected to become normal again with the return of normal trade conditions, enabling the company in due course to resume regular payment of the interest on its debenture stock.

Bristol Tramways and Carriage Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ended June 30th. The dividend warrants will be posted to-day.

Yorkshire Electric Power Co.—The directors have declared an interim dividend for the six months payable on August 1st next at the rate of 6 per cent. per annum on the preference shares, and at the rate of 2 per cent. per annum on the ordinary shares.

Japan.—The Yokohama Electric Car Co.'s report for the last financial half-year shows that £1,730 is being placed to reserve, £15,000 distributed to the shareholders in the form of a dividend at the rate of 8 per cent. per annum, and £500 accorded to the directors, leaving a small balance to be carried forward.

Kalgoorlie Electric Tramways, Ltd.—The accounts show, after providing for interest and sinking fund on the "A" debenture stock, a balance of £6,520 at debit of profit and loss account for 1913.

Westminster Electric Supply Corporation, Ltd.—For the half-year to June 30th, an interim dividend at the rate of 10 per cent. per annum, has been declared, payable September 1st.

STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange this week has swept nearer to the verge of positive panic than it has done during the present century. In fact, members in many markets declare that they have to retrace their memories for nearly a quarter of a century to match conditions so disastrous as those which have been prevailing just lately. Two crises—one in Austria and the other in Ulster—combined to precipitate a slump in Consols which flung down the price by half points at a time. Berlin and Paris joined in with selling orders of their favourite securities. Merits have counted for nothing; the only anxiety was to sell, and not infrequently this was impossible.

Imagination is so prone to exaggerate on occasions so disturbed and agitated as the present, that those in the thick of the scrum can scarcely trust themselves to obtain a calm view of what is actually occurring under their eyes. It would not be difficult to write a heated, even an interesting, account of the wild excitement witnessed in the Stock Exchange during the past few days, but though demoralisation upset the markets, it would be hardly fair to say that actual panic conditions have ruled. The Stock Exchange itself stopped them to some extent by the simple process of declining to deal at all, so that the mild-eyed proprietor of insurance shares, for example—than which, as a rule, there are few more stable stocks—discovered to his astonishment that he was unable to sell at any price during the height of the excitement, although, had he wanted to buy, he would have found almost as much difficulty in obtaining really cheap stock. The violence of the depression was accentuated by the unexpectedness of the rapidity with which the war clouds gathered between Austria and Servia. International bonds fell like rubber shares do in a synthetic scare; and such inter-bourse issues as Brazilian Tractions moved by points within the space of a few minutes.

These Brazilian Tractions, by the way, have proved one of the storm centres of the week. The making-up price on Monday of 65, compared with 78½ at the previous settlement, a fall of 13½ within 19 days; while another perpendicular drop took them since then to 59. Carried over with readiness, as a rule, Brazilian Tractions on Monday encountered refusals that were certainly not looked for on the part of those who generally lend money on the shares. This conduced to necessary forced selling for cash, and for a time the bottom seemed to fall out of the market. The actual declaration of war led to violent relapses in other markets, and fortunate indeed were those securities that escaped being affected by the action of Austria.

Home Railway stocks have had one or two disappointing dividends to contend against, but had the announcements been twice as favourable as anybody expected, it is doubtful whether prices would have been any the better for them. The market has been caught in the swirl of the slump, and Undergrounds have gone down with the rest. Metropolitans, Districts and Underground Electrics show heavy falls, the dividend statements in each case hardly being a factor in the situation.

The London County Council Electric Supply Committee have published their report this week, in which the official effort is made to grapple with the problem that has hitherto seemed insoluble. The recommendations of the Committee are of great interest to many others besides the proprietors of electric lighting shares, while to the latter they will be a reminder of the hints thrown out here of recent weeks as to the likelihood of the next scheme being patterned pretty closely upon that produced by Mr. H. B. Renwick not long ago. The companies are invited to come into co-operation with each other, and we take it that this will be the rock around which most of the difficulties will cluster. The market effect of the scheme would probably have been favourable had other conditions warranted it; but, of course, with everything else flat, the proposals failed to attract buyers for the time being.

On the whole, however, the share market is good, with several small rises to its credit. Cities are 10s. lower, there being still a small "bull" account in the shares; but the three issues of the St. James' Company, for instance, are all higher. Chelseas hardened on the declaration of the regular interim dividend; Charing Cross Preferences are rather lower, while Westminster Preference improved.

Mexican issues are extremely weak. The quite satisfactory news from Mexico concerning the pacification of the country has gone by the board in the pressure to realise any stocks and shares that were saleable at all. Mexico Trams show a drop of nine points; the bonds are two to three points down. In Mexican Light and Power descriptions the falls range from two to five. Latin-Canadians, as a whole, have suffered with the rest of the markets. Manila Electric bonds are one higher, thanks to a very satisfactory report.

In the Telegraph group, the dire necessity for obtaining cash has led to sales of purely investment shares. The declines are small, on the whole. American Telephone and Telegraph stock went back upon the declaration of war. Marconis again developed flatness, the Ordinary falling 5s. to 1¾, and the Preference to 1½. The manufacturing group has held its ground with firmness, and General Electric Preference at 10⅜ are ⅛ higher on the week. Babcock & Wilcox receded, and India-Rubber shares gave way. The Rubber market itself has been weak on a further drooping of the raw material.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations July 28th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅛ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	⅜ — ½	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	16½ — 18½	— ½	..
Do. Do. Deferred	100	..	..	10 — 12	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 89	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	8	8½	54 — 57	..	6 2 10
Do. 5 % Perp. Deb.	100	5	5	91 — 96	..	5 7 5
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 78	—1	5 15 5
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	96 — 97	..	4 2 6
City & S. London, 5 % Pref., 1891	100	5	5	96 — 97	..	5 3 1
Do. 1898	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	68 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½	..	5 15 4
London and Suburban, Ord.	1	..	1	⅞ — ⅞	..	3 10 10
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝ — ¾	— ⅛	8 0 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	73 — 78	..	5 15 5
London Elec. Railways, 4 % Deb.	100	4	4	88 — 90	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	53 — 57	..	7 0 4
Metropolitan Railway Consol.	100	1⅜	1⅜	31½ — 35	—6	4 12 10
Do. Surplus Lands	100	2½	2½	60 — 62	—2	4 8 9
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord.	100	Nil	..	20¼ — 20¾	—5½	Nil
Do. 6 % Deb.	100	6	6	126 —129	..	4 6 0
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4 % Prior Lien	100	4	4	96 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 85	—1	5 6 0
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	⅜ — ⅝	..	8 12 10
Do. 5 % Pref.	1	5	5	⅞ — 1	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	2⅛ — 2⅜	— ⅛	Nil
Do. "A"	1/-	..	..	⅜ — ½	— ⅛	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	113 —115	—4	5 4 4
Do. 4½ % Bonds	100	4½	4½	98 —100	—1	4 10 0
Do. 6 % Income	100	6	6	87 — 88	—3½	6 16 4
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	3	4	4⅛ — 4½	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅛ — 4⅜	—1/16	5 17 4
Do. 2nd Pref.	5	5½	5½	4⅛ — 4⅜	..	6 5 9
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Do. 4½ % Deb.	100	4½	4½	97 —100 xd	+1	4 10 0
Do. 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Auckland Trams, 5 % Deb.	100	5	5	101 —104	..	4 16 8
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅜	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	96 — 97	..	4 12 9
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brasilian Traction, Light and Power	$100	6	6†	59 — 61	—15	9 16 8
Brisbane Trams Invt., Ord.	5	8	8	7⅛ — 7⅜	..	5 8 3
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	104 —108	—1	7 8 2
Do. Pref. Ord.	100	6	6	103 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	101 —104	—1½	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	92 — 96	..	4 13 9
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	—1	4 7 9
Calcutta Trams, Ord.	5	7½	9½	7 — 7⅛	— ⅛	6 6 9
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 —101	..	4 9 0
Cape Electric Trams	1	5	5	⅜ — ½	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 9 0
Do. 4 % Deb.	100	4	4	95 —100	..	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	91 — 95	..	5 5 3
Kalgoorlie El. Trams 5% A Deb.	100	5	5	89 — 87	..	5 15 0
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅛ — ¼	..	..
Do. Pref.	1	4½d.	6	3⅛ — 3½	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1⅝ — 1¾	..	4 9 3
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	5 14 3
Do. 5 % Deb.	100	5	5	93½ — 97½	..	5 2 6
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4½ — 5½	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 —101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	75½ — 78½	..	6 7 5
Manila Elec. R. and Lig., Bonds	$1000	5	5	100 —102	+1	4 18 0
Mexico Trams Com	$100	7	7	63 — 67	—9	..
Do. Gen. Con. 5 % Bonds	..	5	5	82 — 86	—2	5 16 3
Do. 6 % Bonds	100	6	6	74 — 78	—3	7 13 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	..	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	88 — 91	..	5 10 ..
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96	..	4 13 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	—1	5 1 0
Do. 5 % Mort. Bonds	100	5	5	89½ — 90½	..	5 10 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	99 —102	+1½	4 18 0
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4⅝	..	7 7 4
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	6 17 3
Do. 5 % 1st Deb.	100	5	5	95 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9½ — 10½	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	10	8¾ — 9⅜	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	..	4 5 1
Charing Cross, West End & City	5	5	6	5 — 5½	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	— ⅛	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4½ — 4¾	—1/16	5 0 0
Do. Do. 4 % Deb.	100	4	4	90½ — 93½	..	4 6 6
Chelsea, Ord.	5	5	5	4⅝ — 5⅛	+ ⅛	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	..	4 11 0
City of London, Ord.	10	9	10	15½ — 16½	— ½	6 1 4
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	115 —118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 1
County of London, Ord.	10	6	7	11⅝ — 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅝ — 12¼	— ⅛	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£3	..	..	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅝ — 4 xd	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80 — 85	..	5 6 0
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 14 9
Hove	5	8	9	8¾ — 9	..	5 9 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 7¾	..	5 16 8
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 ..
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	..	5 15 ..
London Electric, Ord.	8	2½	3	1⅝ — 1⅞	..	5 10 ..
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8½ — 8¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 18 8
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 11 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 84	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 17 3
Oxford	5	7	7	5⅞ — 6⅛	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9½ — 9¾	+ ⅛	6 1 6
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	+ ⅛	4 16 7
Do. 3½ % Deb.	100	3½	3½	88 — 88	+1	4 1 4
South London, Ord.	4	5½	5½	7⅞ — 8⅛	+ ⅛	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	93 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅝ — 1⅞	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	⅛ — ¼	..	..
Do. 5 % Cum Pref.	5	3½	4	3⅛ — 3	..	6 13 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10	8⅜ — 8⅝	..	5 12 8
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5½	+1/16	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 28th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅛ — 5⅜	..	£ s. d. 5 11 7
Calcutta, Ord.	£	8½	9	7¼ — 7½	..	5 16 2
Do. 5 % Pref.	£	5	5	5 — 5¼	..	4 15 1
Calgary Power, 1st Mort. Bds.	100	5	5	86 — 88	..	5 13 8
Canadian Gen. El. Com.	$100	7	8	97 —102	—1	7 15 6
Do. 7 % Pref.	$100	7	7	116 —121	..	5 15 10
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — ⅞	..	7 12 0
Do. 5 % Deb.	100	5	5	81 — 86	+1	5 16 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	82 — 83	..	6 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	95 — 98	..	5 2 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	98 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Pref.	1	6	4	⅞ — 1	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —102	..	4 18 0
Madras, Ord.	£	Nil	..	1¼ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	104 —107	+1	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	..	7 11 8
Mexican Lt. & Power, Common	$100	4	4†	44 — 47	—2	..
Do. 7 % Cum. Pref.	$100	7	7	69 — 74	—3½	9 9 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	79 — 84	—8	5 19 1
Do. 5 % 2nd Mort. Bonds	100	5	5	60 — 65	—5	7 18 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	1912. 5	1913. 5	48 — 53	..	£ s. d. ..
Montreal, Lt., H. and Power	$100	9	10†	232 —238	..	4 4 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 —101	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	183 —187	—1	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103 —106	..	4 14 4
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 3
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	83½ - 84½	..	5 18 4
Victoria Falls Power, Pref.	1	6	6	31/32 — 33/32	—1/32	8 6 8
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 28th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	£	7	7	11/16 — 12/16	..	£ s. d. 8 12 4
Do. 6 % Pref.	£	6	6	29/32 — 30/32	..	7 2 3
Babcock & Wilcox	£	16	16	28/- — 29/-	— ½	5 11 4
Do. Pref.	£	6	6	1⅝ — 1 7/16	..	4 8 6
British Aluminium, Ord.	£	..	5	1 3/16 — 1 5/16	..	4 14 1
Do. 6 % Cum. Pref.	£	6	6	29/32 — 30/32	..	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	95 — 98	..	5 2 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Heisby Cables	£	10	18	10½ — 10⅝	..	6 1 0
Do. Pref.	£	6	6	6 — 6⅛	..	4 12 4
Do. Deb.	100	4½	4½	100 —108	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	£	Nil	5	1⅝ — 1⅞	..	5 6 8
Do. Deb.	100	4	4	72 — 75	—1	5 6 8
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Browett, Lindley, Ord.	£	..	..	2/- —3/-	..	Nil
Do. Pref.	£	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£	2	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	£	15	15	11½ — 12½	..	6 2 5
Do. Pref.	£	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£	20	22½	2 7/8 — 2 15/16	..	8 15 5
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Dick, Kerr	£	Nil	..	3/32 — 5/32	..	..
Do. Pref.	£	6	6	1/32 — 3/32	..	6 17 2
Edison & Swan, A, £2 paid	£	Nil	..	3/32 — 5/32	..	Nil
Do. fully paid	£	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	£	5	5	15/32 — 17/32	—1/32	8 8 6
Do. Pref.	£	1	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	£	7	7	6½ — 7½	..	9 13 9
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£	6	6	10½ — 11	+ ⅛	5 9 1
Do. Deb.	100	4	4	88 — 92	..	4 7 0
Henley's, Ord.	£	15	20	14½ — 15½	..	6 9 0
Do. Pref.	£	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	£	7½	7½	8½ — 9½	— 1	7 18 0
Do. Pref.	£	5	5	9 — 9¼	..	5 2 7
Telegraph Construction	£	20	20	37½ — 39½	..	6 1 7
Do. Deb.	100	4	4	97 — 99	..	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	37 — 41	..	9 15 1

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 28th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	£	4½	4½	5⅝ — 6½	..	£ s. d. 7 4 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	119 —124	—1½	6 9 0
Do. Collat. Trust	$1000	4	4	99 — 93	—1	4 6 0
Anglo-American Telegraph	Stock	8	8	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107 —109	+ ½	5 10 7
Do. Def.	Do.	30/-	30/-	22½ — 23½	— ½	6 9 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	5	6†	7⅛ — 7⅝	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	— ½	4 17 7
Cuba Telegraph	£	10	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	£	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	£	5	10	7½ — 7⅞	..	6 9 0
Direct United States Cable	£	10	4	6⅝ — 7⅛	..	5 12 8
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	129 —132	—1	5 6 8
Do. 3½ % Pref. Stock	Do.	3½	3½	76½ — 78½	..	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	..	4 2 1
Eastern Extension	£	10	7	12½ — 13	— ¼	5 7 9
Do. 4 % Deb.	Stock	4	4	96½ — 98½	+ ½	4 1 3
Globe Telegraph and Trust	£	10	6	11 — 11½	..	5 4 4
Do. 6 % Pref.	£	10	6	12⅜ — 13½	..	4 11 4
Great Northern Telegraph	£	20	20	31 — 33	— ½	6 1 3
Indo-European Telegraph	£	25	18	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 10 1
Marconi's Wireless Telegraph	£	20	20	1¼ — 1⅜	— ⅛	11 1 0
Do. 7 % Cum. Partic. Pref.	£	17	17	1⅜ — 1½	— 1/16	10 9 2
Monte Video Telephone, Ord.	£	6	6	1⅜ — 1½	..	6 8 0
Do. 5 % Pref.	£	5	5	1⅜ — 1½	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —102	— ½	4 8 5
Oriental Telep. and Elec.	£	10	10	2½ — 2⅝	..	4 7 6
Do. 6 % Cum. Pref.	£	6	6	1⅝ — 1⅝	..	4 13 5
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97	..	4 2 8
Reuter's	£	10	7	7 — 8	— ½	8 15 0
Submarine Cables Trust	£	Cert.	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	— ½	4 11 0
United River Plate Telephone	£	8	6†	6⅛ — 6⅝	..	6 0 9
Do. 5 % Cum. Pref.	£	5	5	5 — 5⅛	..	4 11 0
West Coast of America	£	2½	N	⅞ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	£	1½	1½	1⅛ — 1⅜	— ⅛	9 1 10
Do. 6 % Cum. 1st Pref.	£	6	6	8 — 9	— ½	6 13 4
Do. 6 % Cum. 2nd Pref	£	6	6	8¼ — 8⅝	..	6 16 9
Do. 5 % Debs.	100	5	5	98 —101	..	4 19 0
Western Telegraph, Ltd.	£	10	7	13⅜ — 13⅞	..	5 0 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 — 100	..	4 10 0

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

London's Electricity Supply.—The following appeared in the *Financial Times* of July 24th, "From a correspondent":—At a private meeting recently held, and attended by representatives of the thirteen electrical supply companies operating in the metropolis, the scheme drawn up at the companies' instigation as an alternative to the "super" undertaking proposed some time ago by a group of bankers was submitted, and as no information relating to this important gathering appears to have been published, it may be interesting to give a brief *résumé* of what took place on that occasion. The representatives of four companies, and these by no means the least important members of the group, declined to endorse the project submitted by the companies' own officials, while the remaining nine decided to refer the matter to the consideration of fresh experts. The alternative scheme was distinguished by the fact that it refrained from making any "constructive" proposals, its main purport being apparently to show hat the bankers' project was unnecessary. There is, of course, nothing easier than to criticise the proposals put forward by other people, and this was the opinion of many of those who attended the recent meeting, and particularly, of course, of the dissentients. Apparently the companies' advisers are of opinion that a more favourable site for a central station could be obtained, and that other details of the bankers' scheme might also be modified, though how these improvements are to be effected is left for subsequent discussion. The net result of the inquiry set on foot by the companies with a view to counteracting the proposals submitted to them by the banking interests would, therefore, appear simply to have been to bring about an impasse without tending to solve the problem under consideration. Obviously this state of affairs cannot continue indefinitely, and in financial circles much interest is being shown as to the next step to be taken in connection with the matter. Apparently the banking syndicate will not make any further move until the companies have shown some disposition either to come to terms or else to formulate a concrete scheme of their own.

ELECTRIC SIGNALLING AND THE SENGHENYDD DISASTER.

IN our leading article of a few weeks ago dealing with Mr. Redmayne's report on the Senghenydd explosion, we promised further details regarding the tests carried out on the electric signalling apparatus in what was apparently an endeavour to prove that the explosion was brought about by this means. In our opinion—and we are glad to note this was the opinion of all the practical mining engineers who gave evidence on the point—it was practically impossible for this to be the cause, for the reason that the spark emitted from an ordinary signal bell is not of sufficient intensity to ignite mine gas or "fire-damp." The question is a most important one from a mining standpoint, as Mr. Redmayne's remarks seemed to threaten a new regulation regarding the use of electricity in mines, and this would, we think, do more harm than good. It is at best a foolish policy to pursue any attempt to make accidents an impossibility in any industry by hampering it with legislative rules and regulations, as the industry may become so costly to operate that it is in danger of being regulated out of existence altogether.

Mr. Redmayne says:—This inquiry has shown quite clearly that the exemption from the requirements of the electricity regulations, which applies at present to electric signalling apparatus that happens to have been in use before June 1st, 1911, and that was in conformity with the code of electricity regulations then in force, goes too far. The regulation in the code of 1905 (which code was superseded by the present code in 1912) to which reference is made reads as below:—

In any place or part of the mine where general Rule No. 8 of the Coal Mines Regulation Act, 1887, applies, bare wires shall not be used for signalling circuits except in haulage roads, and the pressure shall not exceed 15 volts in any one circuit. This clearly permitted bare signal wires on haulage roads anywhere below ground even in places where inflammable gas might have occurred in quantity such as would have rendered the use of a naked light dangerous (General Rule 8, Coal Mines Regulation Act, 1887), provided the pressure did not exceed 15 volts, and Regulation 137, paragraph (*b*) of the present code allows the continued use of such wires (unless the Inspector of the district raises objection) until June 1st, 1920. It is clear from the evidence given at the inquiry that a pressure of 15 volts on bare signal wires may be dangerous in the presence of an explosive mixture of firedamp and air, and *I think, therefore, that a modification of Regulation* 137 *is desirable so as to exclude from its operation such signal wires and signalling apparatus as are in use in virtue of the Regulation of the code of* 1905 *quoted above.*

No apparatus other than signal wires was permitted by the code of 1905 to produce external sparks in places where gas might occur in quantity sufficient to be indicative of danger, and my recommendation is that it be made clear that signalling apparatus should be treated in the future as all other apparatus is treated, and that all open visible sparks should be avoided where gas may occur. This will require a slight modification of Regulation 137. I am encouraged to make this recommendation as signalling apparatus which is guaranteed by the makers not to produce an open or visible spark is readily obtainable.

The italics are ours. We do not cavil at any attempt to make a mine safe, and we have no doubt that it is an easy matter to make signalling apparatus that will not produce an open spark *so long as it is kept in order*. But there is rather too much "fool-proof" apparatus being introduced into mines, and the tendency is to employ fools, instead of relying more upon a workman doing his work and using the apparatus to hand with intelligence and care. Further, the manager is neither a competent electrician nor a skilled engineer, *he cannot be everything*, though he does his best to be what he is supposed to be under the present Coal Mines Regulation Act, and instead of placing a thoroughly competent and skilled engineer in charge of the plant, the manager is inclined to accept the manufacturer's word; so long as he complies with Mr. Redmayne's regulations he (the manager) cannot very well be held responsible if anything does happen, and so we go on—muddling along with red-tape rules and regulations, instead of giving common sense and intelligence and thoroughness a fair chance.

Another point in regard to this investigation is the fact that no one seemed to think the cause of the explosion would be the electric signal wires, until this was first put forward by Dr. Atkinson, H.M. Divisional Inspector for South Wales, and supported by his two colleagues, Mr. Dyer Lewis and Mr. Greenland Davies. Mr. Redmayne himself came to the same opinion as Dr. Atkinson, but we read: "As to the point of origin, the opinions expressed placed it at two fairly widely separated points."

Seven practical and responsible mining engineers, including the manager, Mr. Shaw, and one of the Commissioners, Mr. Evan Williams, thought the ignition took place at the lamp cabin, and it seems strange that only H.M. Inspectors should hold opposite views.

There was, however, so much doubt in the minds of everyone as to whether the signalling apparatus could cause an explosion, that a series of tests were carried out at the new Tredegar Rescue Station on June 1st and 29th, 1913, with an explosive mixture of pit gas (methane) from the Gymmer Pit, and out of 28 tests, each test consisting of several experiments, the mixture only ignited five times, in tests No. 9 and No. 11 with a pressure of 13½ volts, in No. 13 with a pressure of 18 volts, No. 14 with a pressure of 22½ volts, and in No. 12 of the second series with a pressure of 11·9 volts. There were two tests with town gas, which ignited *instantly* with a pressure of 13·5 volts—whereas with mine gas, and the same pressures, it took from 20 to 30 seconds, and in test No. 12 it took 4 minutes and 37 seconds of continuous intermittent contact to produce an ignition. Evidently the question of time producing some cumulative effect, probably by the sparks heating the gas in proximity to them, should be taken into consideration, and we must remember that these tests were made in a closed chamber, and not subject to an air current, as the bells would be in the mine itself. Further, in test No. 12 it was not the "Senghenydd" bell that was being used, but a bell belonging to the rescue station, which gave "more sparking than with Senghenydd bells." The voltage used in the signalling apparatus in the Senghenydd pit was said to be only nine volts, and it was found absolutely impossible to get an ignition with this pressure.

The tests, however, were not sufficient to satisfy the Inspectors, and Dr. Wheeler was instructed to carry out some experiments, which are, we think, so interesting, that we give his report in full, as follows:—

On March 21st there were received at the experimental station two signalling bells of the pattern used at Senghenydd Colliery, and a supply of dry cells of the make and size used at that colliery at the time of the explosion. I was instructed to carry out tests to determine the limiting conditions under which the electrical ignition of methane and air mixture could be effected when using a battery of dry cells connected through a bell, so as to form a signalling circuit.

A number of tests have been made, the results of which are given in detail later, using one of the "Senghenydd" bells, and, for comparison, a bell kindly lent me by Prof. Thornton, of Armstrong College, Newcastle-on-Tyne, from whose work our knowledge of the conditions necessary to obtain ignitions of gaseous mixtures by momentary electric arcs is mainly derived.

The experiments described in this report show, as Prof. Thornton's work with high voltages has also shown:—

1. That methane-air mixtures vary in their ease of ignition according to the percentage of methane present, being much more difficult to ignite as the "limit mixtures" (lower limit 5·6 and higher limit 14·8 per cent. methane) are approached.
2. That the inductance of the circuit is of prime importance in determining whether the flash produced on breaking the circuit can ignite an explosive mixture; and
3. That the amperage of the current is of more importance than the voltage.

Before describing the experiments that have been made regarding the general question of the electrical ignition of methane-air mixture, it will be as well to state the results obtained with the Senghenydd bell and cells under conditions comparable with those that would obtain in practice.

The bell was of the usual trembler pattern for continuous working with an iron cover (not gas-tight), which was removed during the tests. The bell had a resistance of 10 ohms.

The experiments were carried out in such a manner that either the bell or the signal wires, by the short circuiting of which the bell could be caused to ring, could be enclosed in a chamber containing an explosive mixture of methane and air. It was found that ignition at the bell, due to the maintained spark at the spring contact, could be obtained with a battery of five cells, the current when the circuit was closed being 0·70 amp., and the voltage across the terminals of the bell being 7·5 volts.

Of more importance to determine was the number of cells required to cause ignition by the flash produced by short-circuiting the signal wires to give a signal. With only the resistance due to the bell (10 ohms) in the circuit, a battery of three cells was sufficient to give a break-flash capable of igniting the most sensitive methane-air mixtures (containing from 8 to 9·5 per cent of methane).

To allow for the resistance afforded by the long lengths of signalling wire used in practice, non-inductive resistance coils were inserted, as shown in the series of experiments below, in

which a mixture of methane and air containing 8·2 per cent. of methane was employed.

Resistance in circuit.	No. of cells required for ignition by break-flash.	Current on closed circuit. Amperes.	Voltage on open circuit.
Bell only (10 ohms) ...	3	0·45	4·5
Bell + 10 ohms	5	0·40	7·5
Bell + 20 ohms	7	0·35	10·5
Bell + 30 ohms	11	0·40	16·5
Bell + 50 ohms	15	0·35	22·5

A resistance of about 13 ohms is given by 1 mile of galvanised-iron signalling wire of No. 8 gauge.

The series of experiments just described were made, as already stated, with an 8·2 per cent. methane-air mixture, which is one of the mixtures most readily ignited. Mixtures containing smaller percentages of methane are less easily ignited, as the following experiments show :—

"SENGHENYDD" BELL IN CIRCUIT.

Percentage of methane in air.	No. of cells required for ignition by break-flash.	Current on closed circuit. Amperes.	Voltage on open circuit.
5·6 (lower-limit)	8	1·15	12·0
6·3 ,,	7	1·05	10·5
7·0 ,,	5	·70	7·5
8·0 ,,	3	·45	4·5
9·0 ,,	3	·45	4·5
9·5 ,,	3	·45	4·5
10·2 ,,	5	·70	7·5

The effect of methane-content on the ease of ignition is better shown when either the voltage or the amperage of the current is kept constant. In the table below are given the voltages required to cause the ignition of different methane-air mixtures by the break-flash when the current passing through the bell was kept constant at 0·60 ampere by the insertion of sufficient (non-inductive) resistance :—

"SENGHENYDD" BELL IN CIRCUIT. CURRENT MAINTAINED AT 0·60 AMPERE.

Percentage of methane in air.	Additional resistance to maintain current at 0·60 ampere.	Voltage required to cause ignition by break-flash.
5·8	70 ohms	70·5
6·0	31 ,, ...	25·5
6·4	13 ,, ...	15·0
6·6	9 ,, ...	12·0
7·3	2 ,, ...	7·5
8·0	nil	4·5
8·2	nil	4·5
8·5	nil	4·5
9·0	nil	4·5
9·4	nil	4·5
10·0	2 ohms	7·5
10·6	9 ,, ...	12·0
12·1	63 ,, ...	63·0

As Prof. Thornton has pointed out (*loc. cit.* p. 152) "with low-voltage apparatus the inductance of the circuit is of first importance from the point of view of safety at break."

This is illustrated by comparative tests made with the "Senghenydd" bell and that lent by Prof. Thornton (bell "A") the inductances of which, according to determinations kindly made by Prof. Thornton, were :—

"Senghenydd" bell : Mean inductance at all currents 0·344 henry.
Bell "A" ,, ,, ,, 0·135 henry.

Whereas with the "Senghenydd" bell in circuit a battery of three dry cells was required to cause the ignition of an 8 per cent. methane—air mixture by the break-flash, with bell "A" five cells were required, the currents being 0·45 amp. at 4·5 volts and 0·7 amp. at 7·5 volts respectively. Both bells had the same resistance, namely, 10 ohms.

The influence of amperage can be appreciated from an examination of the series of experiments with an 8·2 per cent. methane-air mixture, using the "Senghenydd" bell, when resistances of different values were included in the circuit. It would appear that if the current flowing round the signalling circuit could be reduced below 0·30 ampere by introducing suitable non-inductive resistances, there would be but little risk of ignition by break-flashes below 25 volts pressure. The use of Leclanché cells, therefore, owing to their high internal resistance, should afford greater comparative safety than the use of dry batteries. Comparative experiments illustrative of this were made using an 8·2 per cent. methane-air mixture and the "Senghenydd" bell, the results being as follows :—

	Number of cells required for ignition by break flash.	Current on closed circuit. Amps.	Voltage.
Dry cells	3	0·45	4·5
Leclanché cells ...	6	0·50	9·0

Whilst with the bell "A" the results were :—

Dry cells	5	0·70	7·5
Leclanché cells ...	9	0·60	13·5

The opportunity arose of testing a device of Prof. Thornton's intended to prevent sparking at the signal wires and at the bell. The bell used was bell "A" already referred to, and the circuit was modified by the addition of two circuits, termed respectively "Simplex" and "Duplex," which could be connected to the bell separately or together.

The tests with bell "A" alone have already been given ; the effect of adding the special circuits was as follows :—

IGNITION OF AN 8·0 PER CENT. METHANE-AIR MIXTURE.

	No of cells required for ignition by break flash.	Current on closed circuit. Amps.	Voltage.
Bell "Simplex" circuits...	15	2·225	22·5
Bell "Simplex" and "Duplex" circuits ...	15	2·275	22·5

The above results were obtained when a battery of dry cells was used. When Leclanché cells were employed no ignition of an 8·5 per cent. methane-air mixture could be effected with the maximum number of cells available, namely, 24 (current on closed circuit 1·0 ampere, voltage 34·5).

The addition of either the Simplex or the Duplex circuit practically eliminated sparking at the bell.

The preliminary experiments were made with an explosion-chamber of about 1 cb. ft. capacity, in which either the bell or the signalling contacts could be placed. The last-named consisted of two steel rods of ¼ in. diameter, one fixed firmly in position across the box, and the other running parallel with it for a few inches, and then turned at right angles. This bent rod could be moved round or backwards and forwards by hand, so that a rubbing contact or a rapid make and break of circuit could be made.

For the later comparative experiments a mechanical device for making and breaking circuit in an explosive mixture was employed as being more convenient and giving greater uniformity of results. The results obtained by the two methods of experiment were the same, but whereas with the hand-breaks some 30 or 40 contacts had to be made at the limiting voltages before ignition occurred—and the nature of the break-flash depending greatly on the rapidity with which contact was made and broken, and on whether the break at the signal wires synchronised with the break at the bell—with the mechanical break ignition was obtained at the limiting voltages at the first, or sometimes at the second, break.

The apparatus used consisted of a gas-tight wooden box of about ½ cb. ft. capacity, fitted with a glass window, and having one end removed. This end was covered by a sheet of oiled paper, and a measured volume of methane was passed in from a glass holder, displacing air The mixture was then made by rapidly revolving a small motor-driven fan for a given time, and a sample drawn out over mercury into a glass vessel, whence it was transferred to an apparatus for explosion analysis. The methane used was prepared from aluminium carbide and purified by passing through ammoniacal cuprous chloride (to remove traces of acetylene), and over "oxidised" palladium, precipitated, heated at 212° F. (to remove traces of hydrogen). Analysis showed it to contain 98 per cent. of methane and 2 per cent. of nitrogen.

The mechanical contacts and breaks were made by slowly revolving (by means of a motor and gearing) a turn-table carrying four metal rods, each of which just touched the end of a strip of metal fixed at right angles to them. For the majority of the experiments the contacts were steel and steel, but a comparative series was also made with zinc-zinc contacts without any difference being obtained in the results.

The value of the report cannot be over-estimated, as it seems to show some peculiar connection between the current passing and the percentage of gas or methane in the mixtures. Evidently an 8·2 per cent. methane-air mixture is very susceptible to an electric current, and we hope that Dr. Thornton, who has already done so much useful work on this subject, will continue his investigations.

We are, however, at present mainly concerned with the more practical side of electric signalling from the mining point of view, and in conclusion, we quote the following from the report of Mr. Evan Williams, one of the Assessors conducting the inquiry, with Mr. Redmayne as Commissioner ; Mr. Williams is chairman of the South Wales and Monmouthshire Coal Owners' Association, and is therefore entitled to give an authoritative opinion upon the question. He says :—

The evidence as to the electric signalling in this pit was very instructive though not quite conclusive. Whenever a signal was given, either by pressing the wires together or by drawing a file or other piece of metal across them, sparks easily visible must have been produced, both at the signalling point and at the bell. The question is whether such sparks, as produced at Senghenydd Collieries, were capable of igniting an explosive mixture of gas and air. It was made abundantly clear that sparks may be not only visible, but bright and luminous, and still be incapable of firing gas, and that the appearance of a spark was no criterion as to its power in this respect. Nor is the voltage of the battery used as the source of the current in itself a criterion, and it is wrong to say loosely, as is frequently done, that a certain voltage, say, 13½, will fire gas, while another voltage, say, 9, will not. The voltage is only one factor, and not the most important one.

The internal resistance of the cells themselves, of the wires, and of the bell, and particularly the inductance of the bell, have to be taken into account before the actual voltage that causes the spark can be determined. What is called the voltage of the battery is only the static difference of potential on open circuit ; the actual electromotive force when a signal is given is the voltage on closed

circuit with the line and bell in series, and this may, and does differ, very largely between one installation and another, even though the voltages of the respective batteries on open circuit may be the same. In one case, it may be very near the voltage on open circuit, and in another it may be as low as one-fourth of it. The self-induction also, which causes by far the most dangerous spark when the contact between the wires is broken, depends upon the construction of the bell that is used. So that nine volts under one set of conditions of batteries, line and bell, may be more dangerous than 12 volts under another set of conditions, and it cannot be too strongly emphasised that all the characteristics of the signalling installations must be taken into consideration, and the prevailing impression that the voltage of the battery is the only thing that matters, corrected.

In face of the knowledge gained in our investigations on this subject, it appears to me most desirable that the Government should at once carry out an exhaustive series of experiments with a view to determining what may and may not be permitted to be used in mines liable to outbursts of gas.

The system of electric signalling with bare wires possesses, in its simplicity, ease and quickness of manipulation, and its reliability, so many practical advantages over all others that its prohibition would, I am convinced, lead to a big increase of accidents upon haulage roads, and the objection to visible sparks incapable of igniting gas is sentimental only.

Dr. Thornton, of Newcastle, showed us a very simple arrangement of by-pass consisting of a short length of thin wire connected across the terminals of the bell, which rendered a signalling installation quite incapable of igniting with a 12-volt battery a mixture of town gas and air, which, without the by-pass, was ignited by a 4-volt battery with the same bell and wires. (Town gas, owing to its high hydrogen content, can be exploded by a spark that will not fire pit gas.)

Dr. Thornton, who has made more investigations on this subject than any other man in this country, is firmly of opinion that this simple device will remove all risk from the ordinary signalling installations in mines, and I think this should be brought to the notice of all colliery managers by the Home Office.

Dr. Thornton and Mr. Sparks also agreed that the use of alternating current, within the limit of voltage laid down by the Regulation, viz, 25 volts, in place of direct current, would confer complete immunity from danger upon bare-wire signalling. With this there is no sparking at the bell, and the sparking on the line is very weak.

Turning to the consideration of the apparatus in use at Senghenydd, in trying to arrive at a conclusion as to whether there was a possibility of the ignition of gas from this cause, one can only be guided by the experiments made with the actual bells in use at the colliery, and not by anything done with other bells in other places, or with any gas other than natural pit gas.

It will be observed from the results of these experiments at the New Tredegar Rescue Station, given in an appendix to this report, that with a Senghenydd bell no ignition of gas was obtained in an explosive mixture of pit gas and air until a battery of nine cells, giving 13½ volts on open circuit, was used. With six cells giving nine volts, every one present at the station must have been convinced that every possible expedient for producing sparks was tried by Mr. Nelson without result, and that with this combination of bell, line and battery, no spark could be produced that would cause an ignition.

It will be observed also that in these experiments new cells were used, and that consequently the voltage on closed circuit was within a decimal point of the open voltage, so that it may be taken that under these conditions an actual E.M.F. of 8·9 volts was not sufficient to fire the explosive mixture.

It is true that the pit gas used was from another colliery, but Dr. Thornton's evidence was quite definite and conclusive that gas taken from Senghenydd, or any other pit in South Wales, would have behaved in exactly the same way.

Some doubt has been cast upon what was the actual voltage of the batteries in use at Senghenydd, and from Mr. Sparks's evidence it is clear that after a period of rest the pressure on open circuit of some of the batteries composed of eight or nine cells each may have been over 10 or 11 volts respectively, owing to the recovery of the partly exhausted cells during the week-end, or to a less degree in a night. This pressure would fall very rapidly as soon as the bells began to be rung, to what extent is not exactly known, as we have not the information as to the behaviour of old cells that we have for new cells, but we have it from the electrical experts that it would fall much more rapidly in old than in new cells.

I see no reason, therefore, to discredit the statements of the colliery electricians, and when measured by them during working hours, the voltage never exceeded nine on open circuit, although I think the method of measuring the voltage might have been improved upon by using a voltmeter from which the total voltage of the battery, as well as that of the individual cells, could be read without calculation. It was, however, clearly shown that the voltage on closed circuit, in the case of old cells, was less than half that on open circuit, so that the comparison to be made between the experiments at New Tredegar, and the actual working condition at Senghenydd, is as between working pressures of 8·9 volts on the one hand, and something actually below 6 volts on the other, and not between static pressures on open circuit of 9 volts and a possible 11·45 volts for a short time after a period of rest. To my mind the evidence is quite conclusive that the characteristics of the installation were such that no spark capable of igniting gas could have been produced.

There is another point which seems to me to bear upon this question as far as the signalling in the Mafeking hard heading is concerned. *From my own observation underground, as well as from the evidence, I am satisfied that the positions of the journeys at the top and bottom of the incline were such that no signalling could have been going on when the explosion occurred.*

Any sparking that may have taken place could, therefore, be produced only by the accidental contact of the two bare signalling wires.

When two wires are pressed together in any way the surfaces that touch have an area many times larger than the points of contact of a knife edge across them would have, and it is a well established fact that the current necessary to ignite gas increases in direct proportion to the area of the surfaces in contact. The further comparison must, therefore, be made as between the small area of contact of the knife edges at the Rescue Station experiments, and the larger area of the surfaces in contact of the two wires in the mine, and this strengthens my conviction that the possibility of an electrical cause of the origin of this explosion can be entirely dismissed.

The italics are ours, and in view of all that has gone before, we think that this statement ought to be accepted as conclusive that whatever did cause the explosion, it was not electric signalling.

A PROPOSED TESTING INSTITUTION FOR THE ELECTRICAL INDUSTRY.*

(COMMUNICATED.)

YEARS ago the Shipping Industry established Lloyds Register, which has proved a priceless boon to all concerned. In the following article, the proposal is made that a similar institution should be established for the electrical industry.

The effective application of the multitude of rules and regulations pertaining to the electrical world, is so rare that their very existence is a farce over large areas. Year by year, cheaper and poorer materials are more and more used, and it seems almost impossible to improve things without more facilities for testing than exist in the majority of stations. Association R.C. wires are almost supplanted in many districts by the cheaper non-Association wires supplied by reputable firms, and even they too often are displaced by the still cheaper foreign cables, whose only merit not seldom is their low prime cost. Experience shows that the life of many of the cheap dielectrics is short. The material becomes either brittle, or soft and "treacly" after a time, when the wires become a source of danger to their users. The need for weeding out of bad quality flexible wires is possibly even greater. Much of the flex now sold is unsuitable for carrying the heavy shades which have recently come into vogue, particularly where these hang from the roof of a high public building. The modern I.E.E. rules allow high current densities on the assumption that the conductivity of the copper is fully up to standard. If this should not be so, or if the wires should be overloaded, there may be serious heating, and this is particularly likely to happen where radiators have been added to an installation only wired for lamps. These conditions are aggravated where the wires are run near to flues or hot water pipes, as often occurs.

The station staff is supposed to look after installations in the supply area, but in actual practice little can be done effectively to get at the bad contractor, and unfortunately the worst contractor too often sets the price at which work must be done in the district. Should the engineer of the Supply Authority interfere in any specially bad case, the contractor generally states that the material is of the highest class, and when driven into a corner he

*The MS. of this article was received in April last, but was held back pending the result of Mr. Dana Pierce's visit to this country. In view of Mr. C. H. Wordingham's letter published in our last issue, the present seems a fitting time to publish it.—EDS. ELEC. REV.

points out that similar work has been passed by the station when done by another firm, and then asks feelingly why he should be singled out for victimization. Where the supply is in municipal hands, there remains the private appeal to the committee, or worse than all, the contractor himself becomes a member of the Council, when, of course, he gets on to the Electricity Committee, where he may place his expert knowledge at the service of the town. Readers may call to mind cases of this kind where the contractor makes a point of attacking the engineer at all times and for all and no reasons. In many cases the contractors are allowed to do as they like, without let or hindrance, provided only that they bring a constant stream of new consumers on to the mains.

The present system of partial inspection, or none at all, is totally bad. It is unfair to the honest contractor, who is cut out by unscrupulous competitors. It is unfair to the consumer, who does not get what he pays for, and it is bad for the electrical industry, which suffers from the stigma of putting up with shoddy work and materials. The only permanently satisfactory method of dealing with the situation is to provide a recognised authority, which would issue specifications for all ordinary materials and apparatus used for electrical work, such an authority being equipped with an efficient laboratory to enable it to test materials sent to it, and to grant certificates to those which were satisfactory. The benefits, to all concerned, of such an institution would be enormous, immediate and lasting. First of all, it would inaugurate sensible standards in the present chaos of accessories. One need only mention plugs, which have become a byword on account of their unnecessary and silly variations. It would be difficult to estimate the loss which we have suffered from the lack of uniformity in this direction. In many houses people cannot carry even a portable lamp from room to room owing to the plugs being different, and they are thereby prevented from using apparatus which they desire to have.

The Testing Institution would enable reductions to be made in the unnecessary and redundant styles of rubber-covered wires now catalogued. One well-known firm lists the following varieties of I.R. wire: 300 meg. non-Association: taped and compounded; ditto braided. 600 meg. non-Association: taped and compounded; ditto braided. 300 meg. Association: taped and compounded; braided and compounded; taped, braided and compounded. 600 meg. Association: taped and compounded; braided without tape; taped, braided and compounded. 2,500 meg. Association: taped and compounded; braided without tape; taped, braided and compounded. 5,000 meg. taped, braided and compounded. In all there are no fewer than 14 varieties for each size of cable, a number far in excess of requirements. Why, for instance, should there be 600-meg. non-Association, and 300-meg. Association types? When one turns to flexible wires, one finds the same bewildering diversity, many types having been introduced to meet the demand for cheapness, and some of them makers will admit to be unsatisfactory. In some cases one hears that the cheaper wires are as good as, if not better than, the expensive kinds, but if this is so, why should we continue to spend money on the expensive kinds? There is an opportunity here for the Laboratory to do good work, as it is conceivable that it might discover that there was no benefit in using large proportions of pure Para in the insulation of house wires.

The laboratory could do a most useful work by examining and reporting on new materials and apparatus which come on the market from time to time. Under present conditions an engineer tries something new once in a while, but if he happens to have some failures he is apt to fall back on the old and tried materials, to the exclusion of new ideas, an attitude which is detrimental to the industry. Take, for instance, the recent proposal to use cab-tire cables for house wiring. If successful, this style of wiring will prove of the utmost benefit in many cases, being easily run and free from liability to go to earth. But who is to do the pioneer work?

A few years ago, paper lead-covered wire was used on a large scale for house work, and it has been found necessary to pull most of it out. How is one to know that cab-tire will eventually prove better? Then we have a continual flow of new kinds of switches, lamp-holders, and other apparatus, some of which prove good and some very bad. Some of these continue to sell in one district after another long after the original users have found them unreliable, and others progress with a slowness quite unworthy of their merits. So far there is no machinery in existence by which the experience of one user can be published for the benefit of others, and there seems no other means of filling the need save by the establishment of a Testing Institution. In one case, which the writer had to do with, it was found that a new type of insulated wire had so short a life that it should never have been placed on the market. In the course of a few months it became hard, developing cracks all along its length, while its insulating properties practically disappeared. The wire in question was by no means cheap, and it was introduced as the most perfect form of insulated wire to be obtained. In spite of its failure, through a clever selling organization, the makers managed to sell large quantities of it throughout the kingdom, and no doubt many users are now regretting their misfortune in having touched it. Incidents of this kind are by no means uncommon, and the industry should take steps to abolish their possibility.

The benefits of the proposed institution would apply to everyone concerned. The manufacturer would no longer have to produce stuff which he knew to be unreliable, merely to meet the competition of less scrupulous traders, for when putting forward his wares he would know that he was competing only with firms who were bound by the same conditions as himself. The wiring contractor would be protected from the competition of unscrupulous firms who rely on getting low quality materials accepted. The benefits to the consumer of electricity and to the supply authorities are self-evident, and there is no need to enumerate them. The institution would be of particular value in enabling new designs of apparatus to come quickly on to the market, for such would find ready acceptance by users when they had obtained the laboratory certificate, while we should be saved much expense by the rejection of new apparatus which proved unable to pass the stipulated tests. In many cases it would also be found that some of the cheaper designs were quite as good as the more expensive ones, and in this direction alone large savings would ensue to the electrical industry. The laboratory would further receive and tabulate complaints of all sorts from the users of electrical apparatus throughout the whole country, so that it would be able to pass on to manufacturers the accumulated experience of the whole country.

The method by which such a laboratory would be organized and worked would require more discussion than can be set out in an article like the present one, but the following suggestions may serve to open up the subject. The Testing Institution would primarily be controlled by a committee representing the various branches interested in the electrical industry. With the aid of the laboratory it would draw up specifications for the materials most commonly used, such as I.R. cables, switches, lamp-holders, etc., the list being extended as experience was gained. Two or three classes might be standardized to meet various requirements. Manufacturers who agreed to supply to the conditions of

the specifications would become approved by the laboratory, after their samples had passed the tests. Where it was found that the actual materials supplied by any maker repeatedly failed to come up to the specifications, his name would be removed from the approved list. Makers would further agree to mark all their goods with their name or other approved mark, for which purpose the recent decision of cable makers to mark I.R. cables with their names will prove of great benefit. Should samples of the materials, on any installation, fail to pass the tests of the laboratory, then the consulting engineer would be reasonably able to demand that the installation be re-done. (At the same time, however, such contingencies would be extremely rare if the laboratory came into being, as few men would run the risk of putting in unsatisfactory materials.) It might also be found possible to set up local committees in various parts of the kingdom to deal with disputes between station or other engineers and contractors. At present contractors often complain that it is unfair that they should have to accept the verdict of the consultant, who may sometimes not be a particularly competent engineer, while the consultant who accepts something not up to the specification may be liable to very unpleasant consequences should the installation subsequently prove defective. One may remind readers of a case in the law-courts which may be fresh in their memories.

There should be no difficulty in meeting the expenses of the institution. A levy on the supply authorities would provide a good part of the money, while manufacturers, wiring contractors and insurance companies would also contribute. Fees for individual tests would cover the remainder of the expenses.

It may be argued that while the proposed Testing Institution is desirable, it would be unworkable. To this one may point out that something of the sort is done in America, as witness the following taken from the ELECTRICAL REVIEW of May 3rd, 1912:—

'The India-Rubber World' quotes the revised set of electrical regulations isued in 1911 by the Electrical Department of New York City, which provide that the insulation shall be rubber or other homogeneous compound which has been approved, and specify a definite thickness for each size of wire. As a protection against too soft an insulation, the rules stipulate certain tests, among which is the following:—The braiding is carefully removed from a portion of the sample, and the copper wire is connected to one terminal of an electric circuit of which the testing tool forms the other terminal. The portion of the sample, from which the braiding has been removed, is placed on a flat surface, and the tool edge, which is placed across the sample, is pressed down on the insulating cover with a pressure of 5 pounds, which is maintained for about a quarter of an hour. The electric current, which must be at least 100 volts alternating, is then turned on, and the tool edge must not sink far enough through the insulation to touch the copper wire and complete the electric circuit—a pretty hard test for a small wire, but one to which the best manufacturers have agreed.

We may, of course, be content merely to drift along and muddle through somehow, but such a method is unworthy of our traditions, and furthermore this policy is likely to result in incidents which will deal a blow at the very heart of the industry such as may be feared from no competitor.

REVIEWS.

Electrical Engineering Problems. By F. C. CALDWELL. London: Hill Publishing Co. Price 4/2 net.

THIS is another book of problems in Electrical Engineering, also without solutions or explanatory matter. As will be seen from the summary of its contents given below, it covers a very wide field, but the problems are all of a comparatively elementary character, and the earlier ones are evidently intended for the student who is only just beginning the study of the subject.

It will probably be useful to indicate very briefly the subject matter of the problems, in the first place, and then to make a few observations on the manner in which the author's plan is carried out.

Part I deals with direct-current circuits and apparatus, and includes chapters, or groups, of problems on the following subjects:—Ohm's Law, Wires and Wire Tables, Power and Work, Measurement of Current and E.M.F., Magnetism and Magnetic Circuits, Magnet Windings, Generation of E.M.F., Armature Windings, Armature Circuit Calculations, Armature Reactions, Magnetization Curves, Characteristics, Heating and Rating of Dynamos, Dynamo Losses and Efficiency, Motors.

In Part II, alternating-current circuits and apparatus are dealt with. The problems include questions on the alternating circuit, with inductance, resistance and capacity, measurement of power in single and polyphase circuits, transformers, alternator reactions and regulation, synchronous motors, converters and polyphase induction motors.

As already stated, the problems are intended for junior students, and the efforts made by the author to make their solution simple have in a good many cases led to a rather artificial type of question and to the omission of considerations which would affect the correctness of the deductions in practice. Further, the manner of stating the problems is often bald and incomplete, and sometimes the wording is so abrupt as to make it not easy to grasp the real meaning of the question. We should, for instance, have little respect for the thoughtfulness of a student who would solve the following problem without further question:—"Given a round bar 3 inches in diameter, bent into a magnet, and having the length of magnetic circuit 15.75 inches. Find the number of turns necessary to give a pull of 2,433 pounds with a current of 5.27 amperes." The time necessary for the solution of this problem is given as ten minutes, and this may be taken as representing what we conceive to be a serious shortcoming of the whole book. The tendency throughout is to present the problems in the form of a simple numerical statement, ready for solution in a very short time and with the expenditure of little reasoning power on the part of the student. In other words, the problems are rather a series of exercises in numerical calculation than a set of problems for training powers of thought and reasoning.

The first problem in the book is as follows:—"Given three 110-volt tungsten lamps with resistances of 50, 120 and 200 ohms in series, with 330 volts applied across the outside, what will be the difference of potential around each lamp?" The time required for the solution of this exercise is given as 3 minutes. If the problem were put to a practical test in the laboratory, we think its solution would occur almost simultaneously with the closing of the switch, and the "potential around the lamps" might rise to an unexpectedly high value.

In conclusion, while we do not think that this collection of problems is suitable for use as a class-book by students in this country, we have little doubt that teachers who have difficulty in finding numerical examples in sufficient number will be glad to turn to it for suggestions, and that they may find here many useful and suggestive problems which they can adapt to their own use.

Practical Illumination. By JUSTUS ECK, M.A., M.I.E.E. London: S. Rentell & Co., Ltd. Price 1/- net.

DURING the past few years a number of books have been published on the subjects of Light and Illumination, but so wide are they that hitherto no writer has been able to deal fully with them within the pages of a single volume. It may be said at

once, in order to avoid misapprehension, that Mr. Eck has not attempted to do so. As is perhaps to be expected from one who is a high authority on the subject, the arc lamp receives a good deal of attention, although incandescent lamps of the metal-filament type are not by any means neglected.

The object which Mr. Eck appears to have had in view was that of providing a reference pocket book for engineers, electric light contractors and all interested in efficient illumination by electricity, and a close perusal of the 85 pages of which the book consists justifies the expression of opinion that he has succeeded in his aim. All the information given therein is of value; much of it is of exceptional interest, whilst some of the carefully worked out examples given will considerably lighten the task of preparing specifications and estimates for electric light installations.

An attempt is made in the pocket book to guide both customers and installation engineers, to help both of them to reason out each confronting problem and to enable them to arrive much closer to the correct solution than is often the case at present. The author states this apparently lest some readers might think the book had been written to take the place of others that had been published on the subject, whereas Mr. Eck had evidently in mind the encouraging of a more extended study of illumination.

The work consists of twelve sub-divisions, viz.:—Sunlight, artificial light, direct incandescent lighting, direct arc lighting, indirect lighting, light requirements, planning installations, cost of installation and maintenance, fallacies and arguments, size of light units, prismatic glassware for arc lamps, and globes and illumination. Each sub-division is necessarily short, but nothing of a superfluous character is included, and the information is practically offered in tabloid form. Under the heading of "Direct" incandescent lighting Mr. Eck points out very truly that, although the metal-filament lamp has become almost universally used, a large proportion of shades are still designed suitable for use only with the smaller carbon-filament lamp, and when these are used with the larger lamps the appearance is grotesque and the illumination effect unpleasant. That this is true will be readily admitted, and as a large proportion of the objections which one sometimes hears expressed with regard to electric light have to do with the intrinsic brilliancy of the filament, it would appear that were more attention paid to the subject of providing suitable shades it would be to the benefit of the industry generally.

The book is amply illustrated, but there are many reproductions which might have been left out with advantage. The illustrations of the four shades on page 17 are quite crude, and represent old and not up-to-date patterns. Following this unnecessary page is a half page taken up by the well-known "Focusing," "Intensive" and "Extensive" types of Holophane shades, and it would not be too much to say that the book would not have suffered in the slightest had all the blocks of shades been left out. The same remark applies to the illustrations of arc lamps, finished decoratively, on page 31. On the other hand, several of the photographs of premises lighted in different ways by arc or incandescent lamps are of distinct value as showing the effect that can be obtained when the lighting is planned out on scientific lines. The illustration of Messrs. T. H. Wallis's premises in particular is striking, as also is that on page 69 of a school-hall lighted indirectly by drawn-wire lamps. Another illustration of interest and value is that on page 81, showing the use of inverted arc lamps in shop lighting, where it was necessary to fit the lamps with large over-reflectors to prevent the direct rays being transmitted upwards to another part of the premises.

A number of valuable tables are included, one of the most generally useful being that compiled by Mr. W. E. Barrows, and originally published in "The Illuminating Engineer," giving the intrinsic brilliancy of various illuminants. From this it can be seen that the intrinsic brilliancy of the crater of the open arc is more than 200 times that of a tungsten filament operating at 1.25 watts per candle. The tables for direct and indirect arc lighting on pages 47 and 48 are also useful.

A table around which a certain amount of controversy will rage is that given on page 68, showing the cost of 2,000 candle-power for 1,000 hours by metal-filament and Union arc lamps. The debatable points are with regard to the cost of trimming and cleaning, and there are few of those who have had lengthy experience with metal-filament lamps who will agree that if it costs £6 5s. per 1,000 hours to clean 80 metal-filament lamps, it will cost 10s. to clean two metal-filament lamps of larger size used for a similar time. But, many will ask, is it necessary to clean metal-filament lamps at all in the comparatively short space of 1,000 hours? It is true that the slight accumulation of dust and dirt on the globes will render the lamps slightly less efficient, but it is a question whether it will make so great a difference that it would pay to spend over six pounds on having them cleaned. The figures given may be compared with the sums of 4s. 6d. and of 5s. which are given as representing the cost of cleaning and trimming four Kohinoor and one Excello arc respectively. An enclosed Kohinoor lamp requires trimming 36 times in 1,000 hours, at an expenditure, says Mr. Eck, of about 4 minutes a time. A 16-hour flame lamp requires 63 trims per 1,000 hours, and occupies about 5 minutes each time for the most thorough cleaning. In estimating the cost as above then it would appear that Mr. Eck has failed to take into account the time that the arc-lamp trimmers would occupy in walking from the shop to the lamp were a contractor's man employed. If on the other hand the lamps were cleaned by a man on the premises it is strange that it should cost 5s. for him to make 63 visits of 5 minutes' duration to an arc lamp, and yet cost £6 5s. for him to make 80 visits of certainly shorter duration (assuming that he only cleaned one lamp per visit, which is hardly likely) to an installation of 80 metal-filament lamps. There may be some factors which have not been taken into account either by Mr. Eck or ourselves. However, all cost comparisons are highly controversial, and apart from this one question we are disposed to agree with most of Mr. Eck's remarks on the subjects of light and illumination. The book is well written and always interesting, and should prove of value to all connected with the science of illuminating engineering.

THE TRAMWAY CONGRESS.

(*Concluded from page* 159.)

The second day's proceedings were again opened by Mr. STEPHEN SELLON, who read a letter from the Hon. Arthur Stanley, M.P., regretting that he could not be present at the conference. Mr. Sellon also read a telegram that had been received from Mr. Nance, Belfast, thanking the Association for their congratulatory message of the previous day. Later in the morning, Mr. Harry England, vice-chairman of the Association, arrived, and took the chair.

Rail Joints.

MR. R. HUMPHRIES, tramways engineer to the Birmingham and Midland Tramways Joint Committee, dealt with the construction and maintenance of rail joints. Of the many fish-plate joints that had been introduced, he referred only to the Dick, Kerr joint, in which the fish-plate was scarfed into the head of the rail, and the British Standard joint with a simple

six-hole plate. Fish-plates, he said, allowed creeping with change of temperature, and dished joints were inevitable. The Continuous Rail Joint Co. recommended what was practically a combined fish and sole-plate; sole-plates and anchors, however, only postponed the evil day. Joints to be perfect must be strong enough to withstand temperature effects. The author had no hesitation in advocating the arc-welded joint with fish-plates, which he had been using for some time. A motor-generator was fitted into an old tramcar, taking current from the trolley wire, and supplying 250 amperes at 100 volts for the welding work. The positive pole of the generator was coupled to the wheels, and the negative to the arc carbon, with a resistance in circuit, leaving 70 volts at the arc. High-carbon steel sticks were used to feed the arc when filling in dished joints, which occupied a few minutes and consumed a couple of units. The surplus steel was then ground off and the joint filed level, the dish being thus filled with steel as hard as the rail. The fields of the generator were excited from the trolley wire, giving a steady voltage across the arc. Welding fish-plates solid to the rail took about half an hour per joint, and consumed about 10 units. The fish-plates were first removed and the rail was thoroughly cleaned; the plates were then bolted up tight and welded. The cost of filling a dished joint was 1s., and of welding a pair of fish-plates 5s. Fish-plates were welded on special work as well as to rails, and dishes in points and crossings were also easily handled. When the time came for renewals the rails were cut with the oxy-hydrogen blow-pipe. The welded fish-plate joint was at least as strong as the rail, and the conductance of the joint was higher, bonds being unnecessary. A smaller welding set on a four-wheeled cart was also used, and had the advantage that it did not interfere with the traffic. Another welding set was in use in the central repair shops, with which all kinds of work were tackled. The author also described the Thermit welded joint, which, he said, was at least as strong as the rail, with conductance about 9 per cent. lower than that of the rail; the Falk cast-welded joint, which required a portable cupola; the "D.A." system of jointing by welding a sole-plate to the base of the rail with oxy-acetylene gas, the Tudor Company's electrically welded joint; and the Lorain Steel Company's electric butt-welded joint, in which the flat steel bars were welded to the web of the rail with an alternating current of 5 volts, 25,000 amperes.

DISCUSSION.

Mr. SELLON, who was then presiding, suggested that some of the manufacturers should express their opinions upon Mr. Humphries' paper, and possibly upon their own special appliances for curing the trouble that arose from rail joints.

Mr. R. STUTZ, of the Thermit Company, said he was sorry the author advocated the use of welded joints with fish plates. In adopting such a joint for re-construction, or re-laying work they had, of course, to count the additional expense of the fish plates and the bolts. Such a joint, therefore, in his opinion, did not quite fulfil the requirement laid down by the author, that the joints should not be expensive, though it must be admitted that the cheapness, or otherwise, of a joint was only to be judged by the results obtained. The most ideal joint was no joint, but a system of continuous welding.

Mr. J. A. BRODIE (Liverpool) gave his experiences of a mechanical joint that had been largely used in Liverpool for the last four or five years—a fish-plate joint with eccentric bolts. The idea was to prevent any movement at all of the joint, and thereby do away with any trouble which might arise, due to expansion or contraction.

Mr. W. F. ENDEAN said that in the last three or four years he had had a good deal to do with joints that had been hammered and dished. He much preferred the joint which Mr. Humphries had remarked, was approved by Mr. Fitzmaurice. In his opinion it was a method by which companies without much money could get longer life out of their rails before scrapping. He had opened several of the joints since they were put in, and in every case he had found that the new concrete had amalgamated perfectly with the old substance, and that no movement had taken place. The joint was generally better than it was before.

Mr. H. M. SAYERS observed that with regard to new joints, ever since he had had anything to do with tramway permanent-way work he had looked upon the welded joint as ideal. For dished joints he had tried many methods, and he had found that the best was to crank up the fish-plate sufficiently to raise the ends of the rails and then to grind. It involved something more than merely cranking up the fish-plate; the latter had to be fitted to the rail. It was a somewhat expensive method of doing it, but it made the joint as good as new.

Mr. J. W. DUGDALE (Oldham) described some work they had done by the Tudor process. It was now three years since the work was done, and it was giving every satisfaction. With the exception of one joint, none of them had moved, and the exception was due to bad workmanship at the time. In places where they had narrow workings the fish-plate joint was the most satisfactory type. With regard to thumping joints, when the thump or bump first showed itself, a tramway man should at once go to that joint and right away tighten up the nuts and bolts, as was done on the railways. His men did that immediately there was bumping, and it was satisfactory.

A Wakefield gentleman said that there they had concrete stringers, and now they had put concrete right across the road. Since that had been done joints that had given no trouble before were causing difficulties, by beginning to hollow.

Mr. ROBINSON said the subject introduced for discussion by Mr. Humphries was the bugbear of the tramway managers and engineers. What was wanted was something resilent underneath the joint. If a track was laid on resilient material it seemed to him that nothing could ever possibly open it up.

Several other gentlemen contributed to the discussion.

The CHAIRMAN (Mr. Sellon) thought that in the discussion there had been a good deal more about re-construction than about construction. No doubt the matter of re-construction was a very difficult matter. He had obtained some excellent results by bringing up the rails and grinding them level, and the welded fish-plate joint was no doubt a very excellent thing; but he thought they should endeavour to find some system of construction that would not require all these very excellent efforts to remedy defects as they appeared. They wanted some system of laying down the rails whereby they could be assured that a joint would last the life of the rail. No matter what joint might be used, special attention should be given to guard against the rigidity that was so general in tramway construction. The County Council of London had an inverted rail rivetted on the bottom flange of the existing rail and then laid in a huge bunch of concrete. When one wanted to make a rivet head one used a good anvil, and here was provided just the proper anvil for dishing the joints. He believed in trying to get a road of the most elastic kind. When that was done, and proper fish-plates were provided, and if they had got them well fitted when they were laid down, he did not believe that the troubles would occur to the extent that they did at present. He therefore recommended managers to consider whther, as a real engineering proposition, it was not better to follow the example of the railways. They there got a joint which lasted as long as the rail, because there was no rigid bed.

Mr. HUMPHRIES, replying to the discussion, said the special car that was used was an "Old rooster," such as could probably be found on the system of any company. It had been scrapped for passenger work, and it not only answered the purpose he had described but also served as a towing car, and was used in every way possible. He thought the trouble at Wakefield with the concrete was due to the disturbance of the existing track. The mere presence of a creosoted sleeper underneath a joint had dished the latter on the Auckland Company's undertaking. His figures were only comparative for welding work. He agreed that if they could tighten their fish-plates that would as a rule do away with dished joints, but he thought there would be trouble if they pulled up their track say once a month to examine the fish-plates.

Town Planning in Relation to Tramways.

THIS subject was dealt with by Mr. J. A. BRODIE, city engineer to the Liverpool Corporation. The author said that speedy local passenger transport was likely to play a very important part in the development of town areas in the future. The satisfactory arrangement of main lines of communication had until recent years been seriously hampered by the lack of statutory powers, the obstructive attitude of neighbouring authorities, and the want of foresight of those who held the purse strings, and the new roads had been far too narrow; in laying out new areas the distance apart of the tramways would have to be considered, as well as the stopping places, and ample width must be provided for, 80 feet being the minimum for any important main thoroughfare leading towards the centre of the town. The width of the most important roads should be 120 feet if possible, and such roads had been constructed in Liverpool, with the tramways in the middle. The roadway was provided with a clinker concrete foundation overlaid with pitch macadam, and the tramways were laid on wooden cross sleepers, on a clinker foundation covered with grass. The total cost of the 120-ft. road and tramways was no greater than that of an 80-ft. road and tramways paved in the usual way; the cost of new tramway construction in Liverpool was £6,000 per mile of single track, exclusive of overhead equipment, but on the new road, the tramway cost was only £3,000 per mile of single track. Low hedges separated the tramway from the roadway, so that high speeds were permissible. Even in the centre of the town, to widen the road to 80 feet would not cost much more than to construct subways or tubes, while many indirect advantages were gained by the former policy. The essential factor of success in the competition of the tramways with other means of transport was, in the author's opinion, higher speed, which must be taken into consideration in all new plans. The time was not far distant when the present maximum speed on public roads of 20 miles per hour would become the average speed, but combined with speed there must be safety, comfort and economy. Noises and vibration must be minimised, and perhaps rubber tyres might be applied to tramcars; the wear on the tyres would be less than in the case of road vehicles, and would be compensated by reduced wear of rails, reduced maintenance costs, and elimination of the rail corrugation trouble. The noise of the gearing ought also to be stopped, and much could be done to reduce the weight per passenger of tramcars. Track maintenance could be reduced by using the best materials in Liverpool; Welsh stone pavement on a concrete foundation had

lasted for 30 or 40 years with practically no cost for repairs. Numerous town planning schemes were under consideration or preparation, and every opportunity to introduce improved systems and arrangements should be utilised.

DISCUSSION.

ALDERMAN FRED SMITH (Liverpool), agreed with Mr. Brodie that the tramcar must have speed, and they could not get that unless they had wide roads. There was a better feeling in regard to the widening of roads than there was a few years ago. He did not believe that people would travel in tunnels if they could have proper facilities on a properly widened street.

Mr. F. COUTTS (Paisley), urged the desirability of having four tracks for the convenience of fast and slow traffic. Referring to the illustrations of the sections which Mr. Brodie had produced he drew attention to the grass-covered tracks, and said he had a private track and his great difficulty was to prevent grass growing. In his opinion earth mixed with the metal was most disastrous.

Mr. H. R. HOGG (Sunderland) said that to-day they wanted main thoroughfares which were not necessary when the towns were laid out. The cost of macadamising a wide road soon became a very serious matter indeed. A 90-ft. road was about as much as any large town could manage. That gave them room for tramways down the middle, and for plenty of traffic down both sides and footpaths as well. If they had several of these 90-ft. roads, even in such a place as London, he believed they would take as much traffic as one 120-ft. wide. The upkeep of a wide road made all the difference. He did not believe the final cost of widening a road was more than would have been expended had they maintained a wide road before it was needed.

Mr. S. SELLON said he would like to ask Mr. Brodie why he had not contemplated putting tramways down the side of the road. One of the greatest arguments for the motor 'bus was that it deposited its passengers at the side of the road, whilst the tramcars, because of the lines upon which they ran, were restricted as to position. In large towns such as Vienna, Buda-Pest, etc., their tramways were run at the sides and not in the centre, with success. It seemed to him under these circumstances they could get more ideal conditions than if the tramways were in the centre of the road, and they economised the road space enormously by giving other traffic much more of the roadway; at the same time they deposited their passengers on the footpath without requiring the people to walk across the road unnecessarily. He could not see why grass should not be allowed to grow on the track. His difficulty had been to keep the grass properly mown and looking respectable.

Mr. FRED BLAND complained of the type of house that was being put up along tramroads that were being developed.

Mr. W. J. STEEL, the City Engineer for Newcastle, said Mr. Brodie had laid down a sound plan. He was attempting to avoid the mistakes that were made a hundred years ago. Every town of large size had felt the necessity of widening the roads. The cost of doing this in old cities was almost prohibitive; to widen a thirty-feet road to sixty feet in Newcastle would cost, perhaps, from £500,000 to £800,000 per mile. Three-quarters at least of the cost was due to compensation that had to be paid for pulling down property and in meeting other interests. He considered any suggestion to construct tubes to be unsound. He should imagine that 99 out of every 100 persons would preferably travel over-head. Underground ways for trains or tramways were only permissible or desirable when absolutely no other way out of the difficulty was left. The system advocated by Mr. Brodie was, to his mind, the only system they could look to for dealing with the increasing traffic. If the tramways were run alongside the footpaths, they would defeat the very object which Mr. Brodie had in view, and that was high speed. By keeping the tramways in the centre of the road they could give the cross traffic a better chance to observe the coming traffic. If the tramways were alongside the kerb, a higher speed would increase the present danger. Then again, if the trams were put along one side of the street or road, passengers on the left side of the road who might wish to get across to the right side to board a car would have to walk right across the road instead of only half way across, as would be the case if the cars were in the centre of the roadway. If they could have the roads laid out in the way that had been suggested there was no doubt that they would be infinitely safer, cheaper to maintain, and much more convenient. There was a great scheme in London, and very largely in Liverpool, to make ring roads. He argued, however, that these ring roads would not be used by through traffic but only by local traffic.

Mr. ALLEN (Croydon) said he thought they would have to wait until the millenium before such an ideal class of roads could be carried into effect. The making of main roads like that must be an Imperial matter, because the cost would be so tremendous. No main road through a town should be less than 80 ft. wide, because traffic was bound to increase and faster speed was bound to come. The great difficulty authorities had always had when they wished to widen the road was the feeling on the part of shopkeepers that a wide street would interfere with their trade. He believed that to be a fallacy.

The Chairman (Mr. ENGLAND) said he could not see why they should not maintain the same speed with the cars running alongside or near to the footpaths as could be maintained in the centre of the roadway, always provided that the tramways had their own right of way. The chief point that interested them in connection with the paper was the question of speed. The higher the average speed they could maintain, the lower the expenses must be, apart from depreciation of stock, and he thought that if it were possible for them as tramway companies to contribute a reasonable amount to road widening schemes when under consideration, it would be to their ultimate bentfit.

Mr. BRODIE, replying to the discussion, said there was a great deal of road widening going on in Liverpool. Ninety feet did not meet what he thought would be required by the conditions of traffic in the future. Within the last 50 years there had been four millions sterling spent in widening and improving roads in Liverpool, and that figure, he thought, was nothing in comparison with the road improvements that would have to be effected. He favoured the centre of the roadway for cars for two reasons. The first was that they could not prevent cross traffic coming on to the routes, and the second that some consideration must be shown to the occupants of the frontage houses along the routes, especially if the cars were to be run at twenty miles an hour. It was his opinion that people would take the fastest road, and that fast traffic would prefer the ring roads to the narrow streets in the middle of the town, where they would have to slow down. Heavy traffic, for which the ring roads were not designed, could not be kept off the ring roads at Liverpool, and that showed that they at least understood their value.

CORRECTION.—In our last issue, page 158, Mr. Saunders was incorrectly reported as being at Maidstone; we learn that he left that town some four years ago, also that halfpenny fares, other than workmen's fares have never been instituted at Maidstone.

LONDON'S ELECTRICITY SUPPLY.

L.C.C. REPORT.

A LENGTHY report dealing with the establishment of an undertaking for the control, generation, and distribution of electricity in Greater London, was presented to the L.C.C. by the Special Committee on London Electricity Supply, on Tuesday.

After outlining the present situation the Committee say they feel strongly that proper lines of future development should be laid down now, and that they aim primarily at initiating a new policy rather than making any immediate change in the *status quo*.

Technically, the proposed scheme is based on the conclusions contained in Messrs. Merz and McLellan's report (see ELEC. REV. May 1st, page 759), and aims to gradually centralise production, unify distribution, and ultimately absorb all the existing undertakings in the area. The Committee think that the area should include the County of London and such of the districts adjacent thereto as together form, from the geographical and engineering points of view, the most appropriate field of supply, and that this should be dealt with as a whole, in order to secure the proper development of electricity supply so far as regards the commercial and general economical development of the metropolitan area.

The report says the question of the authority to be set up to deal with the electricity supply over an area of this character is a matter of considerable difficulty. Owing to the extension of the area of supply beyond the County of London, the London County Council could scarcely claim to be the sole authority. For one thing, it is proposed not only to include portions of the areas of five other counties and three county boroughs (including East Ham, which will shortly become a county borough) with the area of the county, but also to associate the councils of such areas in responsibility, financial and otherwise, for the scheme.

The Committee think that it will probably be convenient to establish an authority which should contain representatives of the London County Council and the five other county councils and the three county boroughs concerned, and are now taking steps with a view to consulting the councils concerned with regard to this matter.

On the whole, they are of opinion that the efficient and profitable working of the undertaking in the interests of all concerned will be most effectively secured by the adoption of an arrangement under which the capital required should be provided in definite proportions by the authority and the company, the company to have possession of the whole of the undertaking (including any undertakings acquired) for a definite period, subject to full powers of control and supervision by the authority. Under this arrangement they propose that the authority should advance, by way of loan, two-thirds of the capital required for fresh works. The remaining one-third of such capital would be found by the company. As regards the capital involved in the transfer of existing undertakings they suggest that the whole of the money required for this purpose should be provided by the authority. It is proposed that the whole undertaking should vest in the company during the period of the contract. The authority would be empowered to resume possession of the undertaking at the end of the term of the contract, on payment to the company of a sum equal to

the capital provided by it for the purposes thereof. The authority would also be empowered to resume possession of the undertaking, and to do all necessary things in connection therewith, in the event of the company failing to fulfil its statutory and contract obligations. This arrangement provides for complete ultimate ownership by the authority, while it avoids many of the disadvantages which would attach to immediate possession, whether partial or complete.

It is proposed that the new undertaking shall be established and worked by a company to be constituted by statute, subject to effective powers of control being exercised by the authority.

It is essential for the success of the scheme that the area of supply shall be available at the outset. The Committee think that perhaps the best method of securing this would be that the operating company should at the outset have obtained control over a number of the existing undertakings. Failing a sufficient number of existing companies coming forward it may be necessary to consider proposals by other bodies.

The Committee consider that, from the point of view both of the authority and the company, it would be of great advantage to have an intermediate body consisting of a small number of engineering and financial experts who would be permanently appointed and paid for their services. Such a technical committee as this would, under the direction of the authority, act generally for it in executive matters, particularly as regards considering and advising upon technical questions arising. If such a committee were established, they suggest that it might be entrusted with the following duties:—

(*a*) Generally to consider and report to the authority on all matters connected with the establishment and working of the new undertaking on which the decision of the authority is required, and in particular—(i.) To approve designs, plans and systems of generation, distribution or supply, either for the purposes of the new or existing undertakings. (ii.) To approve from the technical point of view all arrangements for the purchase of existing electricity undertakings. (iii.) To approve contracts by the company for the purchase of materials, erection of buildings, purchase of sites and other purposes. (iv.) To approve contracts for the purchase or sale of energy in bulk. (v.) To approve arrangements made by the company for repairs and maintenance.

(*b*) To exercise, on behalf of the authority, such powers vested in the authority under the scheme as may be deemed desirable.

The powers to be conferred upon the new authority, and to be exercised wholly or partially by the operating company, under delegated powers (subject of course to proper control) would include, *inter alia*, (*a*) the acquisition of certain scheduled sites for generating stations, and (*b*) the erection and equipment of generating stations, the abstraction of water from the river, the breaking up of streets, the laying of mains, the construction of tunnels under the river and certain streets, and generally all necessary things in connection with the establishment and operation of the undertaking.

The powers of supply of the undertaking would include the following:—(*a*) the supply of electricity to authorised distributors; (*b*) the supply of electricity to consumers under the powers of any undertaking taken over; (*c*) the supply of electricity for railways and certain power purposes within the area, regard being had in respect of the latter to the existing powers of authorised distributors; (*d*) the supply of electricity for any purposes—(i.) in the district of an authorised distributor with the consent of such distributor, (ii.) in any district where no authorised distributor exists. There would be an obligation on the new undertaking to supply, subject to conditions.

The scheme will give the necessary power to the authority to enter into a contract with a company for the construction of all necessary works, whether of generation or distribution, and for the operation of the new and of existing undertakings acquired, for, say, 50 years.

It is suggested that the authority should exercise the undermentioned important powers of control:—

(1) Approval of all proposals by the company involving capital expenditure.

(2) Approval of the nature of the capital raised by the company and of the terms on which such capital is raised.

(3) Approval, during the last ten years of the contract, of all agreements and contracts entered into by the company.

(4 A scale of maximum charges by the company for energy supplied would be prescribed in the bill. Such maximum prices to be revised by the Board of Trade from time to time upon the application of either the authority or the company. The rebate (if any) to consumers to be fixed yearly.

(5) Powers to take action for the protection of the interests of retail and bulk consumers.

(6) The general powers relating to the electricity supply would be transferred to the authority, with certain necessary exceptions.

(7) An auditor to be appointed by the authority to audit each year, with an auditor appointed by the company, the accounts of the company.

The Committee suggest that powers should be sought to provide for the transfer to the new authority of existing powers of compulsory purchase, and also power to acquire by agreement or take on lease the undertakings of any company or companies or any local authority or authorities in the area, to merge such undertakings in the main undertaking, and to exercise all existing powers in connection therewith.

It would be proposed to include in the bill any necessary powers to provide for the compensation of those who might lose their office through the transfer of such undertakings.

The scheme should provide for the undermentioned arrangements governing generally the relations to be set up between the new undertaking and existing undertakers with a view to securing as far as possible that degree of continuous co-operation and interworking which is so important from the point of view of any scheme of ultimate unification:—

(1) Power to the authority to advance money to existing undertakings to enable them to take bulk supply, lay down standard networks, etc., subject to adequate guarantees.

(2) Approval of the authority to be obtained to the erection of any new generating stations, the extension of existing stations, or distribution networks, subject to appeal to the Board of Trade.

(3) Local authorities who are authorised distributors in the area of supply to be required to take from the new undertaking any additional power required by them if it can be shown to the satisfaction of the Board of Trade that it would be more profitable for them to do so than to extend their own plant. Extensions of generating stations or distributing networks allowed by the Board of Trade shall, as far as the Board considers practicable, be carried out in conformity with the standard system of supply.

(4) The attitude of the authority or the Board of Trade, as the case may be, in regard to proposed extensions by local authorities to be taken into account in connection with the consideration by the respective loan sanctioning authorities of applications for loans for the extensions, and opportunity to be given to the authority to state its views before a loan is granted.

(5) Approval by the authority of all agreements between the company and authorised undertakers, and, subject to appeal to the Board of Trade, of agreements between one authorised undertaker and another, affecting the sale, lease or working of undertakings or generating stations, or portions thereof, or the giving or taking of a supply of electricity.

The scheme should provide for the undermentioned arrangements in respect of finance, in addition to those already referred to:—

(1) The authority to be empowered to raise money for all or any of the purposes of the undertaking by the issue of electricity stock, or other means, upon the security of the new undertaking, and of the rates of the various districts represented or otherwise.

(2) Bodies represented on the authority to be empowered to accept financial responsibility for the London Electricity stock or other security or stock created for providing funds for the new undertaking, apart from those for which the company is responsible, and for defraying the expenses of the authority so far as the same are not otherwise provided for.

(3) The company to be empowered to raise capital, and to raise temporary loans in connection with the working of the undertaking. The company would not have any power to charge the assets of the undertaking.

(4) The authority to be empowered to pay in electricity stock for stations, undertakings and plant; and the company to be empowered to pay in shares for like purposes.

(5) A sinking fund to be established, to be vested in the authority, upon the basis of the capital expenditure in connection with the undertaking being written off in the undermentioned periods—land and engineering works, 60 years; cables, 40 years; power stations and sub-stations, with all plant therein, 25 years; service lines, 12 years; interest paid out of capital, 30 years; and purchase of existing undertakings, 30 years.

(6) A reserve fund to be established and the approval of the authority to be required to the arrangements with regard to the utilisation thereof.

(7) Power to deal as follows with the net revenue from the undertaking—(i.) The payment of interest at an assumed rate of 4 per cent. per annum on the proportion of capital found by the authority. (ii.) The provision of a sinking fund, to be owned by the authority, at the rate of about 2 per cent. per annum on the whole of the capital of the undertaking. (iii.) The payment of interest on the capital found by the company, assumed at the rate of 4 per cent. per annum. (iv.) The formation of a reserve fund calculated at one-half per cent. per annum on the whole of the capital of the undertaking. (v.) The surplus profits over and above the deductions for interest, sinking fund, and provision for reserve, already referred to, would be divided equally between the authority and the company, until the company receives a share sufficient to pay a further 4 per cent. interest upon its capital expenditure, making in all a return of 8 per cent. interest to the company. Any further profits would, as regards 75 per cent., be utilised in giving a rebate on the prices charged to consumers, and the remaining 25 per cent. would be divided equally between the authority and the company.

(8) The authority to be empowered to utilise the profits received from the undertaking in excess of the capital charges on the money raised for the purposes of the undertaking and the establishment expenses of the authority not otherwise provided for, for the relief of rates in the areas represented on the authority, or for such other purposes connected with the undertaking as may be deemed desirable.

In conclusion, the Committee point out that the scheme outlined differs from previous proposals in three important respects:—

(i.) It represents a combination of municipal and private enterprise designed to ensure full control by, and an adequate share of profits to, the public, with the flexibility and commercial enterprise of company management. The best features of both systems of working will thus, it is hoped, be secured. Moreover, under the arrangements contemplated it is hoped that the services will be secured in the working of the new undertaking of those who have wide experience of the electrical industry and of the peculiar conditions obtaining in the area dealt with.

(ii.) It involves the co-operation of the authorities in outer London with the London County Council, and in view of the importance of the outside area to a thoroughly satisfactory scheme of supply the Committee regard this as a very important point.

(iii.) No compulsory purchase of existing undertakings will be entailed, and interference with existing undertakings will be reduced to a minimum.

The keynote of the whole proposal is that it is an offer to the existing undertakings of a means of increasing the efficiency of their present undertakings, or, if they prefer it, an offer of a means of handing over their complete undertakings, upon terms to be agreed, to a central authority. Under the scheme put forward no immediate or drastic "scrapping" of existing capital is contemplated, but a great increase in consumption and a reduction in the selling price will be effected at an early date. The date and extent of this reduction will depend upon the rate at which the existing undertakings realise the advantages offered to them and come into line with the central authority.

The Committee are advised that, having regard to the nature of the subject, it will be necessary to proceed under the provisions of the Borough Funds Act, 1872, as applied to the County Councils (Bills in Parliament) Act, 1903. Ten clear days' notice will, therefore, have to be given by public advertisement that the question of promoting legislation on the subject will be considered by the Council at a meeting to be held on a specific date, which they suggest should be 10th November, 1914.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,653. "Electric glow lamps and methods of manufacturing and operating the same for illumination, heating, and other purposes." C. O. BASTIAN. July 13th. (Divided application on 28,935/13. December 15th.)

16,659. "Transmission of electric waves in the interior of the earth." ERFORSCHUNG DES ERDINNERN G.M.B.H. July 13th. (Convention date, July 11th, 1913, Germany.) (Complete.)

16,660. "Process for directly exciting a Marconi antenna." ERFORSCHUNG DES ERDINNERN G.M.B.H. July 13th. (Convention date, July 11th, 1913, Germany.) (Complete.)

16,661. "Means for pulling off electrical overhead conductors or contact-wires." SIEMENS-SCHUCKERTWERKE G.M.B.H. July 13th. (Addition to 30,045/13. Convention date, July 12th, 1913, Germany.) (Complete.)

16,696. "Railway block telegraph signalling apparatus." O. W. BRAIN and C. A. HODGSON. July 13th. (Complete.)

16,712. "Telephone systems, more particularly for police and fire-alarms." G. L. HUGHES and R. E. COOPER. July 13th. (Complete.)

16,776. "Apparatus for producing galvanic or electrolytic deposits." P. I. OZIL. July 14th. (Convention date, July 15th, 1913, France.) (Complete.)

16,797. "Additional use for the tapping key of any telegraphic transmitting apparatus." A. E. NIBLETT and D. C. SHARP. July 15th.

16,809. "Means of insulating and gripping insulated wires in electric-lamp-holders and fittings." B. DEAKIN. July 15th.

16,819. "Automatic electric safety catches or locks." A. A. SMETHURST and G. W. SIZER. July 15th.

16,828. "Electric sign or display system and apparatus therefor." E. M. WILDEY. July 15th.

16,833. "Control gear for electric burglar alarms." LICHTENFELD BURGLAR ALARM CO., LTD., and S. LICHTENFELD. July 15th.

16,839. "Telephone apparatus." E. A. GRAHAM. July 15th. (Complete.)

16,850. "Manufacture of incandescent electric lamps." H. G. FINCH, otherwise known as LORD GUERNSEY, and J. F. POYNTER. July 15th. (Complete.)

16,860. "Protective arrangements for electric installations". SIEMENS-SCHUCKERTWERKE G.M.B.H. July 15th. (Convention date, July 15th, 1913, Germany.) (Complete.)

16,869. "Electric meters." BRITISH THOMSON-HOUSTON CO., LTD. July 15th. (General Electric Co., United States.)

16,897. "Means for locking the detachable connections of electric lamps and their holders." H. J. G. JONES. July 16th.

16,901. "Electric furnaces for producing steel and iron." C. BRACKELSBERG. July 16th. (Complete.)

16,905. "Devices for correcting the difference of phase in telegraphic receiving apparatus." A. C. BARONIO and K. L. WOOD. July 16th.

16,915. "Apparatus for converting or transforming electric currents." K. T. WANG. July 16th.

16,935. "Combined dynamo and accumulator electric systems." SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. July 16th. (Convention date, September 24th, 1913, Belgium.) (Complete.)

16,936. "Control systems for electric installations. SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. July 16th. (Convention date, September 24th, 1913, Belgium.) (Complete.)

16,941. "Electrical apparatus." H. J. G. PESSERS. July 15th.

16,945. "Electrometers." B. SZILARD. July 16th. (Divided application on 20,008/13, September 4th. Convention date, October 15th, 1912.) (Complete.)

16,962. "Galvanic devices applicable to boots and shoes and like footwear." H. J. BIGGIN. July 17th.

16,963. "Insulating the joints of electric railway rails." J. A. SUTCLIFFE. July 17th.

16,979. "Cooling-arrangements for dynamo-electric machinery. SIEMENS-BROS. DYNAMO WORKS, LTD., and E. O. KIEFFNER. July 17th.

16,983. "Automatic magnetic fastening for the doors of railway carriages." G. R. PEARSON. July 17th.

16,984. "Circuit breakers." G. ELLISON. July 17th.

16,986. "Dynamo-electric machinery." HON. SIR C. A. PARSONS. July 17th.

16,988. "Wireless telegraphy systems." A. PEDERY, F. FORBATH, and D. VARSANYI. July 17th. (Complete.)

17,004. "Machine switching telephone systems." WESTERN ELECTRIC CO., LTD. July 17th. (F. T. Woodward, Belgium.) (Complete.)

17,007. "Apparatus for automatically exchanging incandescent bodies." SVENSKA AKTIEBOLAGET GASACCUMULATOR. July 17th. (Convention date, July 19th, 1913, Germany.) (Complete.)

17,022. "Filament supports for electric incandescent lamps." JULIUS PINTSCH AKT. GES. July 17th. (Convention date, February 11th, 1914, Germany.) (Complete.)

17,023. "Incandescent electric lamp filaments and method of mounting the same." JULIUS PINTSCH AKT. GES. July 17th. (Convention date, February 16th, 1914, Germany.) (Complete.)

17,025. "Electric pocket lamp and the like." G. F. HITZELBERGER and NEW BRITISH EVER READY CO., LTD. July 17th. (Complete.)

17,033. "Lighting devices for illuminating purposes." A. W. BEUTTELL and A. W. BEUTTELL, LTD. July 17th.

17,036. "Electric gas-lamps." A. LEDERER. July 17th. (Convention date, July 19th, 1913, Austria.) (Complete.)

17,037. "System for the operation of electric winding-motors and the like." S. H. ECKMANN. July 17th.

17,038. "Systems and methods of electric motor control." L. G. RILEY. July 17th. (Convention date, October 3rd, 1913, United States.) (Complete.)

17,052. "Means for supporting electric lamps." M. J. D. CARTER, G. MAURICE, and M. J. RAILING. July 18th.

17,065. "Apparatus for use in the electro-deposition of metals." S. O. COWPER-COLES. July 18th.

17,082. "Electric starters for use on motor-cars and the like." A. H. MIDGLEY and C. A. VANDERVELL. July 18th.

17,089. "Process and apparatus for the electrolysis of halogen alkalies." SIEMENS & HALSKE AKT. GES. July 18th. (Addition to 18,102/13. Convention date, July 26th, 1913, Germany.) (Complete.)

17,105. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. July 18th. (Automatic Electric Co., United States.) (Complete.)

17,110. "Ball or roller bearings with electric insulation." C. E. WIESELGREEN. July 18th. (Convention date, July 22nd, 1913, Sweden.) (Complete.)

17,111. "Electro air-percussion apparatus." G. ROBINSON, H. ROBINSON, and H. KIRSCHEN. July 18th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

12,428. AUTOMATIC ELECTRIC CONTACT APPARATUS. V. Von Vangel. May 28th.

12,578. ELECTRICAL REGULATING SYSTEMS FOR VARIABLE-SPEED DYNAMOS. W. J. Mellersh-Jackson. (United States Light and Heating Co.) May 29th.

14,741. REGULATORS FOR USE IN CHARGING ACCUMULATOR CELLS FOR MOTOR-CAR LIGHTING AND STARTING AND FOR SIMILAR PURPOSES. W. H. Scott. June 26th.

14,807. MANUFACTURE OF METALLIC FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS. J. A. Scoular, and Dick, Kerr & Co. June 26th. (Addition to 11,455/12.)

14,892. VACUUM TUBES. British Thomson-Houston Co. (General Electric Co. June 27th. (Cognate application 25,849/13.)

14,947. RAILWAY SIGNALLING. W. R. Sykes Interlocking Signal Co., J. C. Sykes and R. W. Tarrant. June 28th.

15,064. DEVICE FOR DETECTING COMBUSTIBLE OR EXPLOSIVE GASES, ESPECIALLY FIRE-DAMP Accumulatoren Fabrik Akt. Ges. and F. Rüsse. June 30th.

15,175. SOUND-TRANSMITTING DEVICES FOR TALKING MOTION PICTURE APPARATUS. W. G. Hammack. July 1st.

15,251. ELECTRIC RELAY SYSTEMS AND APPARATUS THEREFOR. A. W. Harris. July 2nd.

15,516. MEANS FOR USING AUXILIARY PETROL ELECTRIC SUPPLY FOR ELECTRIC RAIL CARS, TRACKLESS TROLLEY VEHICLES, AND THE LIKE. W. A. Stevens. July 5th.

15,673. WIRELESS TELEGRAPH TRANSMITTER. J. G. Balsillie. July 7th. (September 23rd, 1912.)

15,721. STAND LAMP REFLECTORS. P. M. Hotchkin. July 8th.

15,748. TELEPHONE SYSTEMS. W. D. Derriman (Russell). July 8th.

15,780. APPARATUS FOR THE TRANSMISSION OF AUDIBLE SIGNALS. R. Klinger. July 8th.

16,027. ALKALINE ELECTRIC ACCUMULATORS. E. Foss, F. Harris, and B. W. Parker. July 11th.

16,157. MEANS FOR INDICATING WHEN LAMPS, SUCH AS THE TAIL LAMPS OF MOTOR-CARS AND LIKE VEHICLES, BECOME EXTINGUISHED. W. H. Taylor. July 14th.

17,174. ELECTRIC FUSES OR CUT-OUTS. C. W. Cox. July 26th.

18,069. LAMPS FOR VEHICLES. T. L. Griffiths. August 8th

18,355. ELECTRODES SUITABLE FOR ELECTRIC ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) August 12th.

22,138. RAILWAY SIGNALS. J. E. Bousefield. (Dutton.) October 1st.

22,390. SYSTEMS AND METHODS OF CONTROL FOR ELECTRIC MOTORS. N. W. Storer. October 4th. (October 5th, 1912.)

24,226. SAFETY DEVICE FOR USE IN CONNECTION WITH ELECTRIC MOTORS. W. Rogers and J. S. Davies. October 25th.

25,497. LAMPS FITTED WITH REFLECTORS. Robert Bosch (firm of). November 7th. (December 31st, 1912.)

26,356. FIRE-PREVENTING AND EXTINGUISHING SYSTEMS. T. P. Shaw. November 17th.

1914.

226. ELECTRIC FURNACES. I. Rennerfelt. January 5th. (January 4th, 1913.)

314. LAMPS FOR PROJECTION. R. I. Atherton and D. B. Jones. January 5th.

540. ELECTRIC INCANDESCENT LAMPS. Westinghouse Metallfaden Gluhlampenfabrik Ges. January 8th. (January 13th, 1913.)

3,197. METHOD OF AND MEANS FOR EQUALISING THE POTENTIALS OF GROUNDING POINTS. A. B. Clark. February 6th. (October 29th, 1913.)

4,436. APPARATUS FOR UNDERGROUND ELECTRICAL SIGNALLING IN COLLIERIES. E. Edwards. February 20th.

4,979. WINDINGS OF DYNAMO-ELECTRIC MACHINES. F. Ljungstrom. February 26th. (April 8th, 1913.)

5,246. TELEPHONE SYSTEMS. T. Shaw. February 28th. (February 28th, 1913.)

5,506. CASING FOR PORTABLE ELECTRIC BATTERY LAMPS. B. Pordes. March 4th.

6,050. INCANDESCENT ELECTRIC LAMPS. R. W. Birkett and J. H. Weiss. March 10th.

7,465. ELECTRIC IGNITION SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. C. F. Kettering and W. A. Chryst. March 31st. (November 20th, 1912. Divided application on 7,545/13, March 31st.)

9,051. LAMPS FOR MOTOR VEHICLES. B. R. Banks and Brown Bros., Ltd. April 9th.

10,493. INDUCTION REGULATORS. Siemens-Schuckertwerke Ges. April 28th. (April 29th, 1913.)

10,945. BRUSH-HOLDERS FOR MULTIPOLAR ELECTRIC MOTORS. Robert Bosch (firm of). May 4th. (March 5th, 1914.)